

ACTIVE SOCIAL WORKPLACES

University College London

The Bartlett School of Graduate Studies

MSc Built Environment: Advanced Architectural Studies

Final Report

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Abstract

This thesis studies three engineering consultant office buildings with the objective of establishing how similar organisations, placed in different spatial systems, create relationships within work groups and between different work units.

Accepting that society is seen through the prism of space, it is argued that work groups create spatial and transpatial relationships within, and between, such work groups. Office spatiality and transpatiality is found to be affected by two main factors. First spatial properties create the links between the local and the global scale, allowing social interactions and frequent useful contacts within, and between, different groups, and, secondly, the office management model create the social rules that shape people's socio-spatial encounters.

The theoretical background gives the main spatial, social and management thinking leading to the descriptive and analytical strategies using Space Syntax tools. The main argument of this research project is that localized work groups, with global spatiality and transpatiality, can override real and social distance between, and within, work units. Under these conditions the division of office labour will reinforce mechanical or organic solidarity in the same working society, creating 'social harmony' and, consequently, the efficient transition between scientific and social knowledge that reforms office organisations into active social work places.

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1.0 Introduction

'Work organisations are undergoing a period of rapid change. Driven partly by changes in technology, coupled to the globalization of markets and business processes, and partly by changing lifestyles and aspirations of the workforce, the modern work organisation has begun to outstrip current theories of organisational structure, let alone theories of the design of work environments'. (Penn, Desyllas and Vaughn, 1999, p.193)

Researchers from a variety of academic fields are addressing questions on how building design might, in principle, relate to organisational function, through the construction of interfaces. There is incomplete knowledge on how movement and interaction are related to work activity within an office. This thesis develops such knowledge, and expands analytical methods for different organisations for socio-spatial relations within, and between, workgroups.

Three engineering consultant office organisations, located in Newman Street, London, Price and Myers, Buro Happold and Whitby Bird, are studied. The aim is to understand the degree to which similarities, and differences, in office organisation depend on spatial and management properties.

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If society is seen through the prism of space, office organisations can be seen as a mutual relationship between physical and social settings. The descriptive and analytical strategy of this research adapts the concept that office organisation operates like society, and that the office building is similar to the spatial configuration society inhabits. Organizational management is seen as a set of rules that affect the social, cultural and economic factors of every office organisation, with office societies shaped through spatial and management configurations.

The key concept behind this thesis is to establish how spatial and management models influence spatial and transpatial relations, and, consequently, labour divisions within the same working group and between different working teams, to provide new ways of efficient social and scientific knowledge transition in the work environment. The question which arises is the extent to which spatial and social distance between employees can be overridden for people to meet and interact.

Chapter 2.0-Literature Review presents a brief theoretical review that relates how changes in office building design and the nature of working over previous decades has been affected by the built environment. It also discusses offices as cyber spaces as well as physical setting. Finally it explores the office's social values and analyses them as forms and spaces for knowledge, while exploring the issue of organisational management. **Chapter 3.0-Case Studies** uses descriptive methods and interview data to explain the most important features of the firms studied, as well as their built environments, and identifies employees' socio-spatial contracts. The next two sections, **Chapter 4.0-Methodology** and **Chapter 5.0-Findings** present the research methodology, and describes the syntactical analysis, using Space Syntax tools along with observational techniques. The main aim is to present employees' organisation-accommodation relationships regarding the work environment and their social interactions. Spatial properties and activities are compared with social contacts, on a local and global scale, sketching the relationship, and the division of labour within, and between, working units. In **Chapter 6-Conclusion** the study project is summarised and recommendations are presented.

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Thesis Strategy

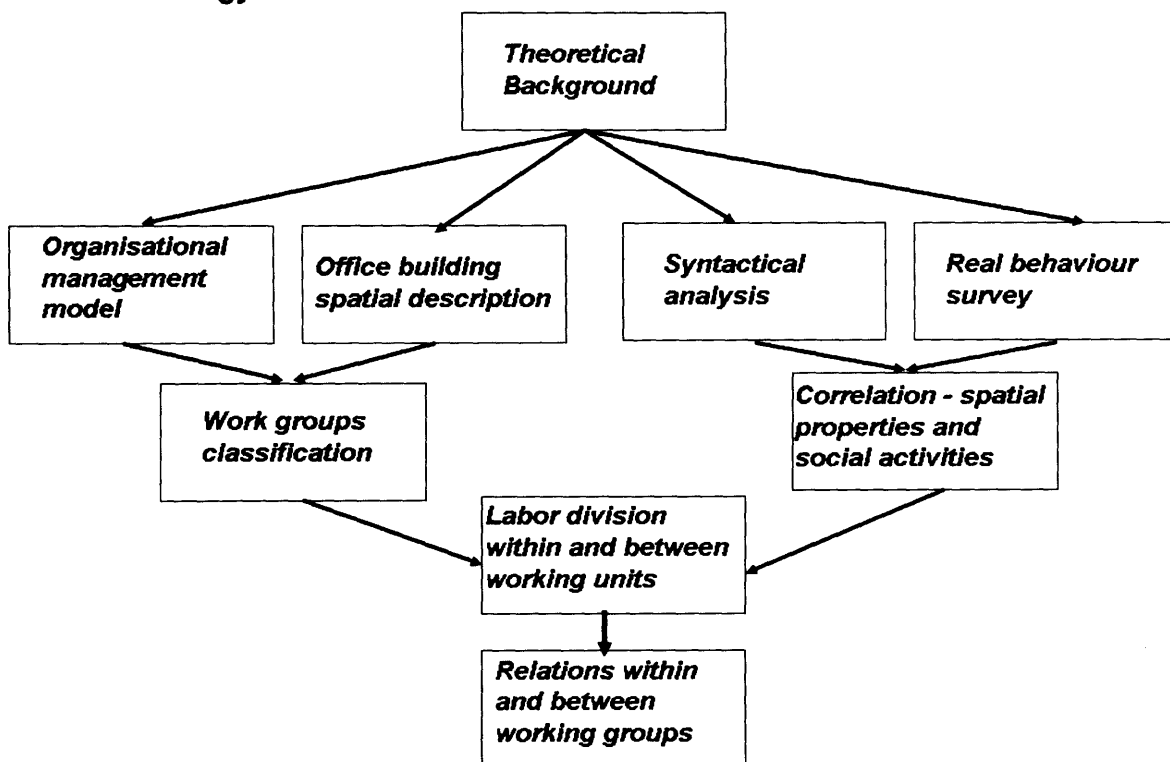


Figure 1.1. Thesis strategy

2.0 Literature Review

Introduction

Office organisations consist of a wide range of architectural design approaches to the work environment, and a variety of social systems to sustain their work force. Organisational changes in business have accelerated rapidly over recent decades, and demand for changing organisational conditions in the work environment, and in social systems, are being called on to play an active role in helping generate new organisational structures for offices.

The literature review looks at the current thinking on office organisation and is divided into two parts. Firstly the theoretical background to changes in office building design and the nature of work alterations in recent decades; looking at office spaces as both cyber spaces and as physical settings. The second part studies the social values of offices; describing them as forms and spaces for knowledge, and explores the issue of organisational management.

2.1 Changes in Office Environment

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Early in the twentieth century there were few new ideas on organisation theory or on office design. In the second half of the twentieth century the argument that office architecture was in need of a radical redesign was established. New concepts in office design aimed to attract, and protect, work staff, to inspire their creativity, and to increase company's productivity. *'The key to the design of the new working environment is productivity – of both workers and, just as significantly, of space'* (Duffy, Laing and Crisp, 1993, p.429).

In the 1960s, the interplay between the physical office environment and emerging ideas of improved workspaces and organisational structuring was established. A very popular innovation was the open landscape plan design (Palmer and Lewis, 1997). In that period, broad office capital investment categories were incorporated within the building shell and the interior architecture furniture systems. Office technology started to play an active role in office functionality and communication. Changes in office design affected office organisation, aimed to engage organisational effectiveness through integrating social and spatial values within the office environment (Handy, 1984).

2.1.1 Box Type to Open Plan Offices

Briefly reviewing the change on work environment in the second half of the last century, it is necessary to first concentrate on office space layout. Changes in office design derived from the idea that office space has a strong value, shaping how people work with each other and how efficiently the organisation performs; especially in new situations demanding flexibility and quick responses (Becker, 1990). The main idea was to affiliate space, people and job process into the workplace (Marmot and Eley, 2000).

The common space pattern of the office building from about 1960 was the box-type office transformed to an open plan layout (Mills, 1972). The open plan design concept offered a range of ways for arranging surroundings to suit individual requirements, giving freedom of movement and visibility independent of position (Palmer, Lewis, 1997). On economic grounds box-type offices used more space to accommodate and facilitate the work staff. Experience with open plan offices covers a much shorter span of time and space (Figure 2.1), the open plan office has developed a positive image with the passing of years (Duffy, 1992).

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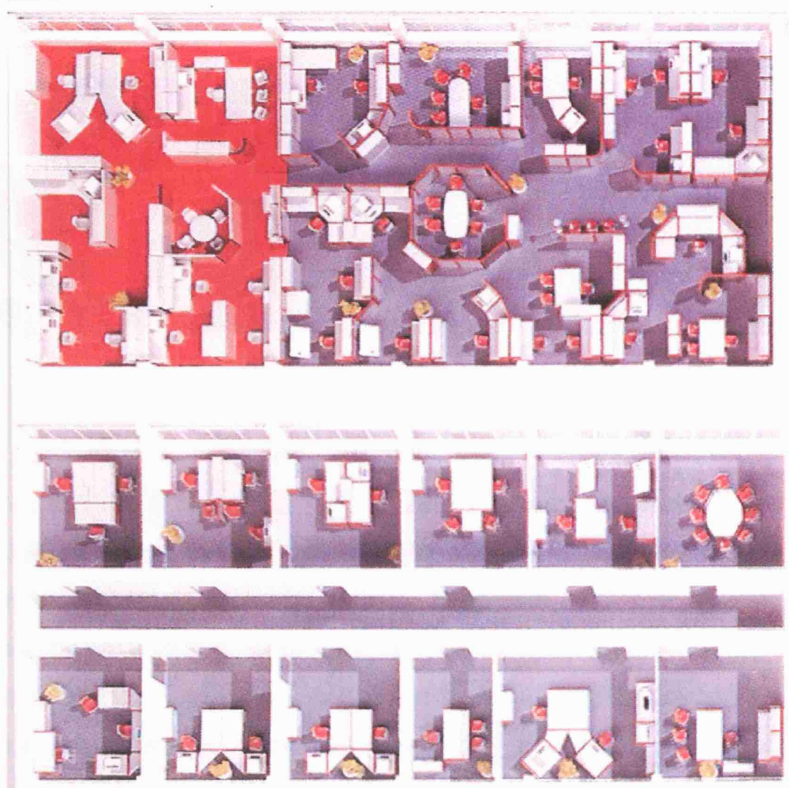


Figure 2.1 Office open plan in compare to box type plan, Marmot, Eley, 2000

As Kraemer, Sieverts and Partner (1997, p.9) write about open plan office buildings '*Communication routes or traffic flows can be changed without having to consider space restrictions*'. The open plan layout offers easily reached spaces; providing the flexibility to reform working space according to a project's needs (Figure 2.2). Consequently equal working conditions for all employees and closer contact between them were achieved through design.



Figure 2.2 open plan office building

2.1.2 The Virtual Office

Changes in office space and organisation were influenced by the development of technology, and technological inventions, such as the Internet and e-mail, which have been adopted by most organisations today (Figure 2.3).

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Figure 2.3 Office technologies from 1960 till today

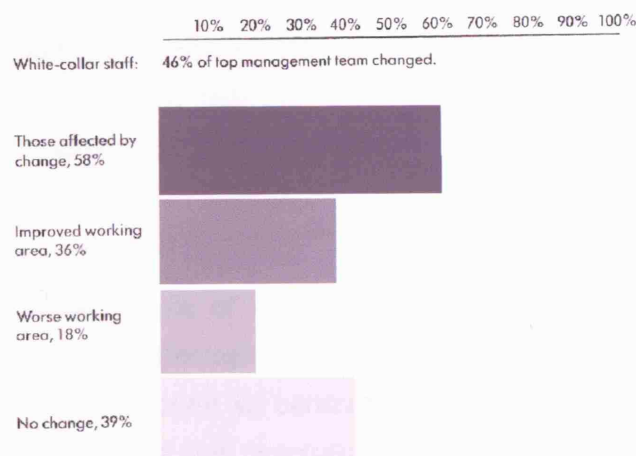
One important attempt to define, and explain, the notion of cyberspace was by Kitchin (1998) arguing that cyberspace allows flexible interaction by people or with computer-simulated worlds. Many thoughts on the flexibility technology provides have been written, with one of the most critical that by Stewart (2004, p.5) who holds that an individual office worker's ability to perform various kinds of tasks without much supervision derives from the use of computers, and that '*...workers become more autonomous making many of their own decisions*'.

It has been proposed that organisations' sociality can be transformed through technologies, thus contributing to new forms of interaction among staff. Previous studies have shown the significant effect technology has on people's movement and face to face interactions. Spiliopoulou and Penn (1999) suggest that although electronic communications are artificial ways of communication, physical space has an important impact on the generation and practice of e-mail and telephone communication, together with managerial aspects such as type of job and seniority. This research project concentrates on physical space impacts on working communication encounters.

2.1.3 Space as a Physical Setting

Acknowledging that physical organisation in a work environment is the space within which the organisation is accommodated and operates, this paragraph considers workspace as a sum of physical conditions as previous analyses placed emphasis on physical parameters of office design. *'Office space conditions affect user comfort and behaviour'* (Vischer, 2005, p.80). This concept is embedded in most theories nowadays, providing that the medium for effective work accommodation and versatility allowance is the physical space of organisation (Peck, 1996). According to Steen, Blombergsson, Wiklander (2002, p.2), *'The desire to increase efficiency in a given production process leads to the physical-spatial conditions as the means of production that will be given a very specific design'*.

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Source: 'Office Environment Index' study

Importance of the office environment

Figure 2.4 Importance of the office environment, Marmot, Eley, 2000

Accepting that office environment affects the efficiency of working methods (Figure 2.4), this paragraph deals with the space features that are appropriate for providing effective workplaces. Penn, Desyllas and Vaughn, (1999, p.194), argue that *'the work environment is considered as a facility whose function is to bring the maximum leverage to bear from the disposition of the organisation's resources both human and environment'*. More specifically their studies on office buildings concludes that the spatial patterns in workspaces affect patterns of movements and people's interactions, behaviours and uses. Hillier (1966, p.246-250) adds that the relationship between the working process and physical-spatial conditions are developed through action. Effective working action, according to Handy (1993), deals with the logic of group task necessities and on the functional requirements of the organisation as a whole, rather than on the logic of individual rank and status. Secondly work space requires opportunities for individual focus and concentration as well as features for team work. In this manner, according to Handy, space allows the 'unexpected' in the building; the information that is transmitted when walking around. Other office studies show that work efficiency is derived through the interplay between external and internal organisational information (Steen, *et al.* 2002).

It is concluded that despite a better understanding of aspects of the relationship between office activities and premises, different demands on different physical-spatial systems need to be understood. As such the shape of each floor, the location of facility cores (usable spaces like toilets, storage rooms, etc.), the number of floors, and the working group spatial division, determine the first factor. The idea is to create places where people come together not only for planned meetings and face to face teamwork but also for the efficiency of unanticipated meetings and the exchange of information.

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2.2 The Office as Form and Space of Action

On the social phase of workplaces there is significant literature, with an influential role played by Becker (1990) and Duffy (1992). Duffy in his study argues that *'Never have offices been so central to society...office buildings have managed our cities, and office work has revolutionized our society'* (Duffy, 1992, p.64), and this section deals with social values derived through the transformation of workspaces.

2.2.1 Brief-relation between office organisation and workspace

The change in office organization inspired Duffy, et al. (1993) to argue that work can be humanised by understanding workers' needs and designing workplaces that are motivated by these needs. Therefore Duffy and his team propose the question of written communication-the brief. Consecutively brief aims to create functional and productive work places but in the same time sociable, creative and comfortable. The brief helps to plan long-lasting buildings that are designed for economy in use and provides undifferentiated spaces that can be adapted to future needs. Integration between the social and physical organisation within the office environment in order to create social relations was the main proposal, highlighting the fundamental nature of how an organisation and its spatial potentials engages valuable work in conjunction with non-work activities.

2.2.2 Social Workplaces

Inspired by Duffy's ideas, office organisations can be seen as a mutual relationship between physical and social settings. Moreover *'...office buildings are significant places in the expansion of human knowledge ecology...are exceedingly complex like living objects'* (Kleeman and Walter, 1991, p.4).

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There is a wide-ranging background to the importance of this concept, as, for example, Hall's book *The Hidden Dimension* (1914) brought together a range of anthropological and sociological information with the theme of providing an answer to how people perceive space, how they use it, how they shape it, and how it shapes them. The relationship between office space and people, according to Vischer (2005) is an organization-accommodation relationship. This relationship is dynamic and interactive, and, when it works effectively, provides strong benefits and support to employees. *'From an organisation-accommodation point of view organisations are in a continual state of evolution and change, adapting, or adapting to, the space they occupy'* (Vischer, 2005, p.26). In addition such an environment creates the value of collaboration in a work environment. Collaboration is defined as *'Processing of information... primarily through peripheral channels and is used to maintain an on-going knowledge of others' locations, activities and intentions'* (Mills, 1972, p.41); while effective collaboration entails both individual, focused, tasks and interactive group work (Schewartzan, 1993).

Vischer (2005, p.xiv) also argues that every office organisation provides a set of basic ideas on the relationship between space and status; *'I feel space meets status follows in this spirit, providing a very compatible look into the real effects of work settings on people's day-to-day lives'*. From the above ideas workspace is the pattern of influences people experience from knowledge and effectiveness in settings, and is commonly defined as a socio-spatial contract, based on territoriality, job performance and work environment.

It is concluded that office organisation and physical space are interconnected through organization-accommodation relationships which develop work collaboration, and through socio-spatial contracts, which distinguishes people through their performance.

2.2.3 Knowledge Spaces

Seeing workplaces as amalgamations between physical and social settings, office organizations can be extensively analysed, both as spatial and social systems, Stewart's (2004, p.6) viewpoint is adopted. He draws a parallel between an office building and a city and, consequently, between society and employees, where he says *'One such model that seems to have captivated designers is the concept of the office as a city'*.

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What are the key mechanisms that link space to society, accord workspaces to employees, and create forms and spaces for action? How is society/work staff seen through the prism of space? In answer Hillier and Hanson (1984), in the Space Syntax theory propose that human settlements are mediated by spatial laws that shape the social construction of space. Different relationships create configurations that in each spatial case create a different co-presence among people through their effects on movements. It is argued that employees expand themselves socially through different spatial working systems. The Space Syntax theory proposes that spatial patterning varies with socio-cultural and micro-economic rules and tends to affect co-presence and thus cities, resulting in integration on the local and global scale.

'Society has both hardware and software' (Hillier, and Netto, 2001, p.13.7). The hardware is the interaction between people and the software the rules governing these interactions. Software in an office organisation is the organisational management that forms the rules in each company. Organisational management plays a vital role in the socio-cultural and microeconomic phase of each 'office-city'. *'Management is a rational process of setting desire parameters, planning how an*

organisation will perform, and ensuring compliance', (Vischer, 1996, p.39). In this manner, management makes decisions about the strategies the organisation has to follow: firstly to shape the status of the company, to define tasks and innovation levels, in other words its culture; secondly to distribute working staff and to divide office hierarchy-society; and thirdly to increase organisation's income-economy. Organisational management shapes the socio-cultural and micro-economic factors of the work society; namely the software. The hardware is shaped through society's texture to form fluid groups with the aim of creating interactions among staff (Hillier and Hanson, 1984), which emphasises the distinction between spatial and transpatial groups. It is argued that there is a correspondence between social and spatial groups, as each society is dependent on space. Society is also grouped together through shared identities, in each case creating transpatial groups. The office-society is a strong spatial group as it is related in the close proximity of space but is also related through shared ideas, such as status and jurisdiction, creating transpatial groups. In the case that managerial decisions and spatial properties correspond to each others, spatiality and transpatiality reinforced the same and create strong localised groups, with the same identity. Spatial systems increase, or decrease, the interactions between different spatial and transpatial working groups, on the transaction of knowledge, scientific or social, and, in this way, produce more, or less, knowledge work places (Steen, 2001). *'The character of social knowledge is that it is automatically used and that one usually learns it through actions... scientific knowledge is concerned with the learning of abstract principles and we are conscious of using these principles when we apply them'* (Hillier, 1996, p.246-250). The right balance according to Space Syntax theory is transpatial relationships to overcome distance and to control proximity; but spatial relationships have to generate, and sustain, the workplace. The aim is not to reinforce relations within the group, but to reinforce relations between different groups (Penn, Desyllas and Vaughn, 1999).

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In summary, focusing on the nature of office work, and the significance of space and society, spatial configuration affects work efficiency as well as employees' behaviours and relationships. Organisational management plays a fundamental role and can strengthen or weaken this interplay, shaping different social groups in the company through its social and spatial rules. The following chapters discuss how socio-spatial contracts affect encounters within, and between, working groups, how organisational-accommodation relationships create spatial and transpatial working groups, and how office 'hardware' and 'software' bind together social and scientific knowledge for efficient delivery, creating a balance between distance and spatial proximity.

3. Case Studies

Introduction

This chapter highlights the similarities, and differences, of the managerial models and the built environments of three case studies. Office organisational data was selected through interviews, unpublished private organisational statements and companies' web pages. The aim of this chapter is to first identify the 'software' of each office society and then to observe the space where the 'hardware' operates.

3.1 Organisational Management

| | Whitby Bird | Price and Myers | Buro Happold |
|---------------------------|--------------------------------|-----------------------------|--|
| Office organisation | | | |
| type | company | partnership | partnership |
| leaders | 22 directors | 12 partners | 26 partners |
| offices | 9 offices | 2 offices | 14 offices |
| management core | management + people's meetings | Partners +management +teams | executive board +design and technology board |
| quality control | team brief +client feedbacks | employees feedback | all levels regular feedbacks |
| meetings | task level +board | Associates +partners | executive board +design and technology board |
| London's office occupancy | 260 people | 135 people | 164 people |

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The table 3.1 demonstrates office organisations according to their type, leadership, size, managerial cores and quality control techniques. Focusing on each office organisational model, the aim is to illustrate a working group-classification table to be used in the Results chapter as a method to associate social interaction with group features so as to understand how management rules affect employee encounters.



Figure 3.1 The three Office Buildings, Newman Street, London

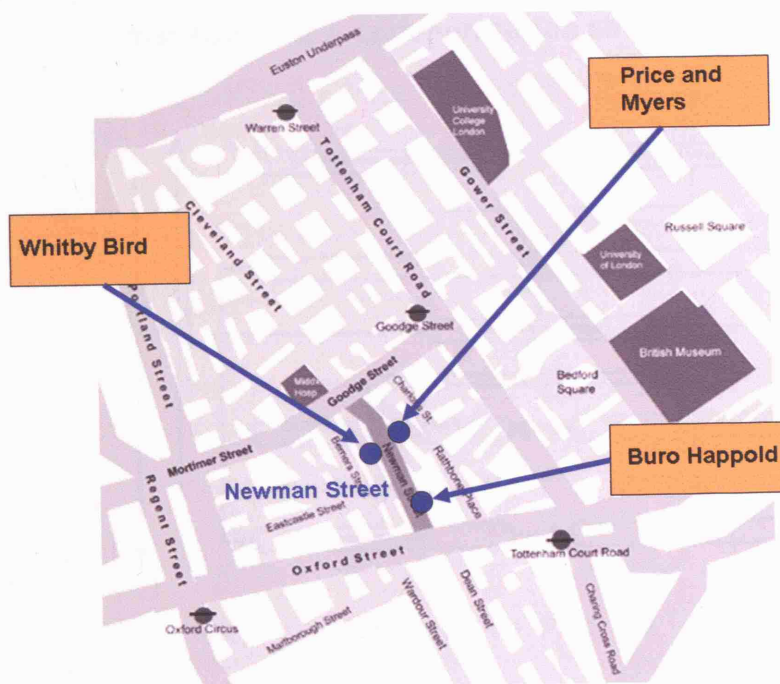


Figure 3.2 Offices Location, Newman Steer, London

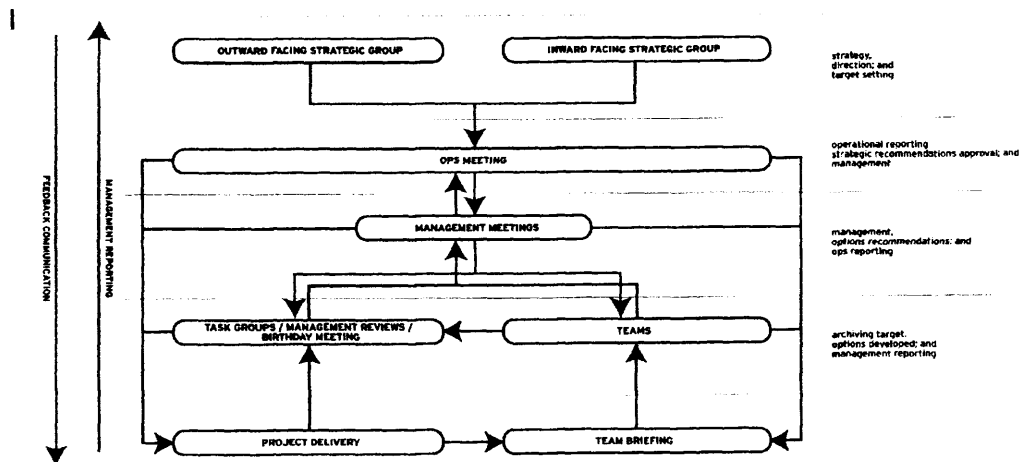
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Whitby Bird

Whitby Bird was created in 1985 and consists of nine offices in the UK. The company is an 'investor in people' *'through the people we employ and through positive, encouraging leadership at all levels'*. There are currently 22 directors across the whole company. London's management strategy, which has an autonomous-local structure incorporating a communication policy, joins different work jurisdictions under the concept of the firm as a whole. The main idea is a bi-directional statement between operational and management meetings with teams (Figure 3.3). In this way, managerial decisions are filtered through task-groups,

reviews and meetings, allowing employees of differing status and roles to actively take part in organisational decisions. Communication strategies provide transpatially and spatially-related groups, through the construct of specialised permanent membership groups, which occupy specific working locations. In this way team members are related through common tasks, aims, duties as well as spatial proximity. The relationships between different groups have spatial features due to different units placed in close proximity; on the same floor and collaborating in projects to allow people from different units to gain a clear image of the work as a whole (Whitby Bird, 2006).

management & communication strategy



21

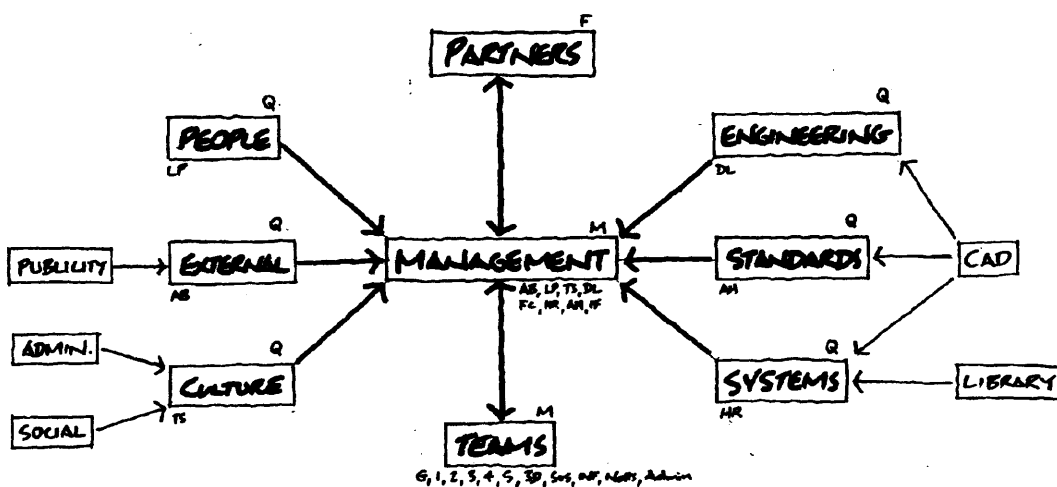
Figure 1.1 Management and communication strategy

Knowledge sharing is via an Intranet, seminars, various technical and management meetings, as well as team meetings, training and project presentations (<http://www.whitbybird.com/>). Success is measured at a number of levels. Firstly there is financial success '*as without it, the business would not survive*', that can be measured via annual accounts, and, secondly, according to the number and type of projects won. Quality of engineering in terms of innovation, creativity, problem-solving, expedience and excellence are gathered via feedback from the clients.

Price and Myers Consulting Engineers was established in 1978 and has grown steadily into a practice of over 100 personnel, with offices in London and Nottingham (<http://www.pricemyers.com/>). Price and Myers organizational management provides a local policy with the main aim to ensure that all work which leaves the office is to a proper standard of design concept, completeness, presentation quality and accuracy. *'This results in good communication and teamwork, with cross-fertilisation of ideas and experience'*.

Price and Myers office organisation is a partnership of 12 with nine associates. The office management, in collaboration with partners and teams, is responsible for every decision taken, with a direct and equal involvement. From this viewpoint engineering standards and systems, and people are mixed to deliver knowledge to the outside world (Figure 3.4). The management model does not include any cost-business centre in their organisational management, and the groups are not economically independent, but are united under London office's aims and responsibilities. The key to their organisational management is to entrust the make-up of a meeting to one, or more, associates each time to allow employees to actively take part in organisational decisions and strategies. *'We trust new people... we need new ideas'*. All the partners and associates are actively involved in project designs. The practice operates in permanent partner engineering groups, bringing spatially and transpatially through common duties, aims and close spatial proximity; creating strong localised working units.

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Knowledge sharing is via lunchtime job presentations and 'Problems and Successes' sessions, which allow everyone in the practice to take part, and to ensure work quality, enabling feedback on projects to be communicated around the practice (Price and Myers, 2006).

Buro Happold

Buro Happold was founded in Bath in 1976. Nowadays it is an international multi-disciplinary engineering and strategic consultancy for the built environment, with over 900 staff in 14 offices all over the world (<http://www.burohappold.com/>). Buro Happold organisational management maintains a strong group of core services in the London office.

The organisation is a partnership directed by 26 partners all over the world. Their global culture and values, are designed to become the world's best integrated multi-disciplinary engineering and strategic consultancy (Buro Happold management, 2005). They operate through many offices and workgroups, using continuous management alterations with the main aim to become a uniform service 'Being a 'one-firm' firm' (Ted Happold).

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Management Model

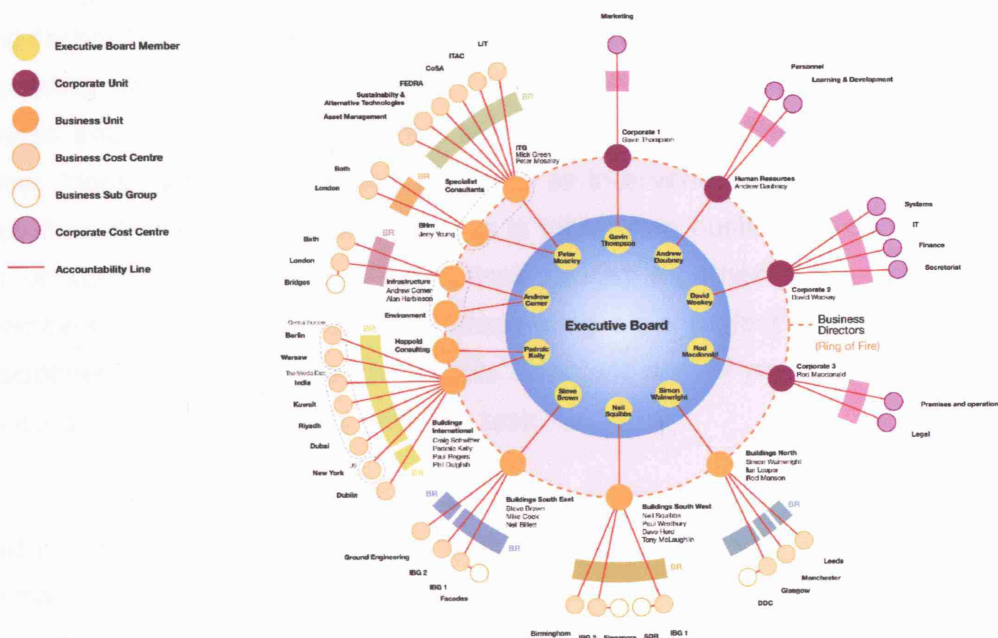


Figure 3.5 Organisational management Buro Happold



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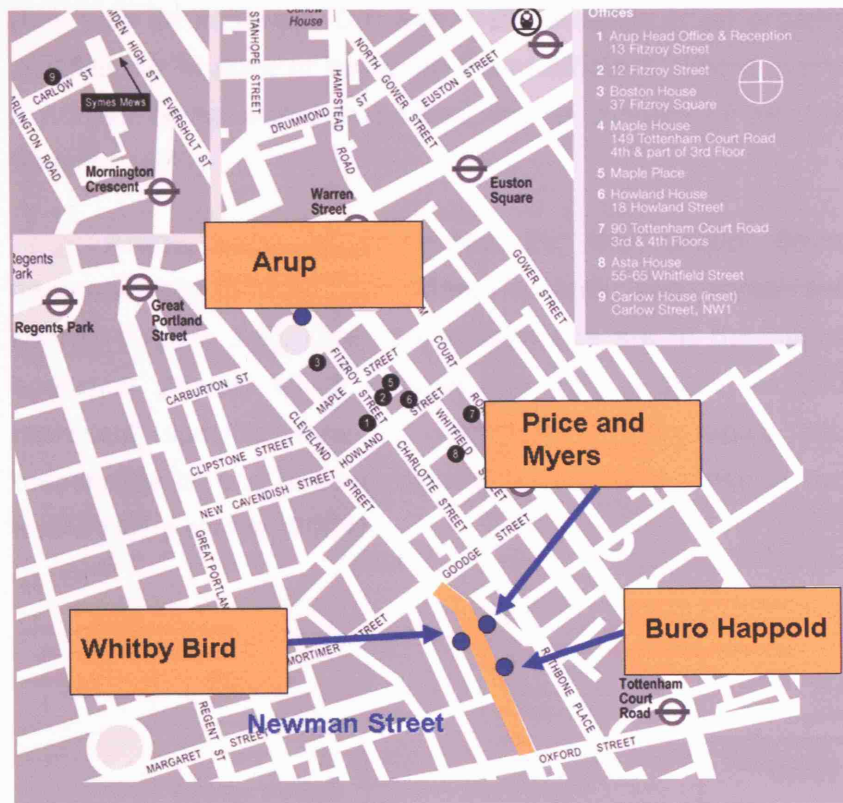


Figure 3.7 Arup, Whitby Bird, Price and Myers and Buro Happold offices locations

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It is interesting to compare the organisational features of the three case studies with the Arup organisation, as Price and Myers' and Buro Happold's main partners were previously members of Ove Arup and partners. Arup organisation is located in Fitzroy Street, London close by the three office organisation case studies (Figure 3.7). Arup was established the 74th out of the 100 best companies to work for, creating a prototype for the way productivity is combined with creativity and social aims in the office organisation (R. Caseby, 2006). It is of interest to study whether the case studies have made an equivalent 'statement' on forming creative and prominent structural engineering organisations.

Arup is a global firm, formed in 1946, providing engineering designs. The firm now has over 7,000 staff based in 77 offices in 33 countries. Throughout the world they aim to provide a consistently excellent multi-disciplinary service, which incorporates their concern for the environment (<http://www.arup.com/>).

Sir Ove Arup, the founder of the Arup organisation, on 9 July 1970 spoke to a meeting of his partners from practices around the world bearing the Arup name. The name of 'key speech' for this talk has endured, in recognition of the fact that in it Ove both states the aims of the firm and analyses, , the principles through which

they may be achieved 'Our aim is the creation of an organisation which is human and friendly in spite of being large and efficient. Where every member is treated as a human being whose happiness is the concern of all' (Sir Ove Arup, The Key Speech, 1970)

Arup policy is developed by the Group Board, advised by four geographically-focused operational boards and three sector-focused strategic boards (Figure 3.8). Operational decisions are in the hands of approximately 80 operating groups, which vary in size from a dozen to 200 or more, and which represent specific areas of technical or geographic activity. Each group is responsible to one of four regional boards, and these in turn report to the Group Board (Arup profile, 2004).

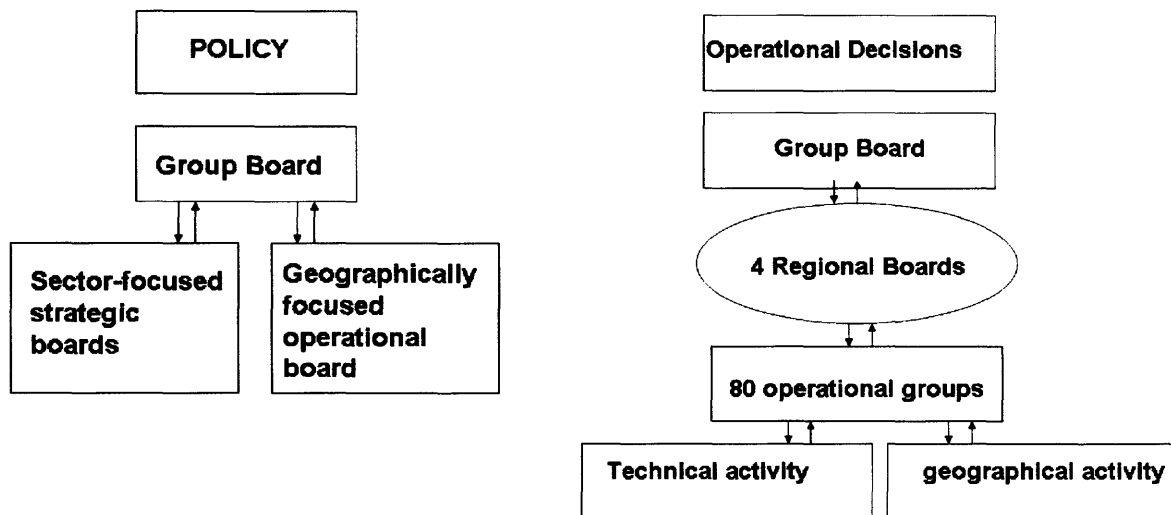


Figure 3.8 Organizational structure of Arup

Arup therefore provides a global managerial model with profitable working groups. It can be argued that the Buro Happold management model follows almost the same strategies as Arup. Both organisation structures are consisted of policy and operational boards that deliver functioning decisions through different geographically boards. The basic difference between Arup and Buro Happold is that Arup's policy and operational management are based on the same sector; the group board in compare with Buro Happold that is consisted of the executive board regarding policy management and design and technological board regarding operational decisions. On the micro scale, working groups of the two partnerships follow the same management, since they operate as independently profitable units.

The Price and Myers and Whitby Bird managerial model is different since the policy and operational decision core is a combination between office's partners, associates and task groups. In this way, managerial decisions are filtered through task-groups, reviews and meetings, allowing employees of differing status and roles to actively take part in organisational decisions. These two organisations provide a local policy to compare with Arup's and Buro Happold's global model (Table 3.2).

| Arup | Price and Myers | Whitby Bird | Buro Happold |
|----------------------------------|-------------------------------|------------------------|---------------------------------|
| acoustic | structural engineering | Structural engineering | structural engineering |
| architecture | building services engineering | industry | planning |
| automotive | fire engineering | renovation | building services |
| airports | façade engineering | bridges | site infrastructure |
| bridges | special project | 3D engineering | water |
| development planning | bridges design | sustainability | transport |
| electronic engineering | geotechnical engineering | | environmental impact assessment |
| flow engineering geotechnical | sustainability and renewable | | specialist consulting |
| highways | | | water bridges |
| industry | | | Bridges |
| lighting | | | Façade engineering |
| microclimate design | | | |
| nuclear industry | | | |
| rail | | | |
| sustainability | | | |
| vehicle design | | | |
| water | | | |

Table 3.2 Arup, Whitby Bird, Price and Myers, Buro Happold and Buro Happold

3.2 Spatial Description

This section describes the office environment of the three organisation cases studied. It shows that the buildings vary in floor shape, size and individual space. The height and placement of furniture inside the working space create different environments (Table 3.3).

| | Whitby Bird | Price and Myers | Buro Happold |
|--|--|--|---|
| Office building spatial description | | | |
| typology | rectangular with tables in horizontal rows | parallelogram with tables in the perimeter of the space | a combination of trapezium and parallelogram with tables in horizontal row |
| number of floors | 6 floors | 7 floors | 4 floors |
| actual size | 6,618 m ² | 3,444 m ² | 4,437m ² |
| facilities | lunch area +kitchen 14 meeting areas 6 coffee points library reception area terrace-pub | lunch area and kitchen 1 meeting area 7 coffee points library reception area terraces | lunch area +pub in the veranda 30 meeting areas 2 coffee points library reception area 4 hot desking |
| Workplace size/individual space | 550m ² /0.6m ² | 150m ² /1.0m ² | 350m ² /0.5 ² |
| Working desks height | 725 mm | 725 mm | 1050 mm |

Table 3.3 Office building spatial description

Whitby Bird

The Whitby Bird office building is a rectangular open plan with six floors. The total area is 6,618 m², and the workplaces 550 m² each. The working desks are placed to divide the space into three parts (Figure 3.9).

The columns of the building in relation to the placement of desks, of conventional 725 mm height, and the storage boxes, create two main routes. The individual space is 0.6 m² for each employee. Small paths are formed in between the desks but most of the time these are interrupted by the storage boxes. Three staircases connect all the floors from two sides of the building. Access to the ground floor working area is indirect, as people have to cross the reception area, or walk underneath the main staircase, to reach the work place. The fourth floor is not occupied and the fifth is in temporary use. All the floors have coffee points, printing points and meeting areas. The office library is located on the ground floor. On the first floor a rectangular void visually connects the first with the ground floor. The

building also provides bicycle parking in the basement as well as a kitchen and lunch areas (Figure 3.10).

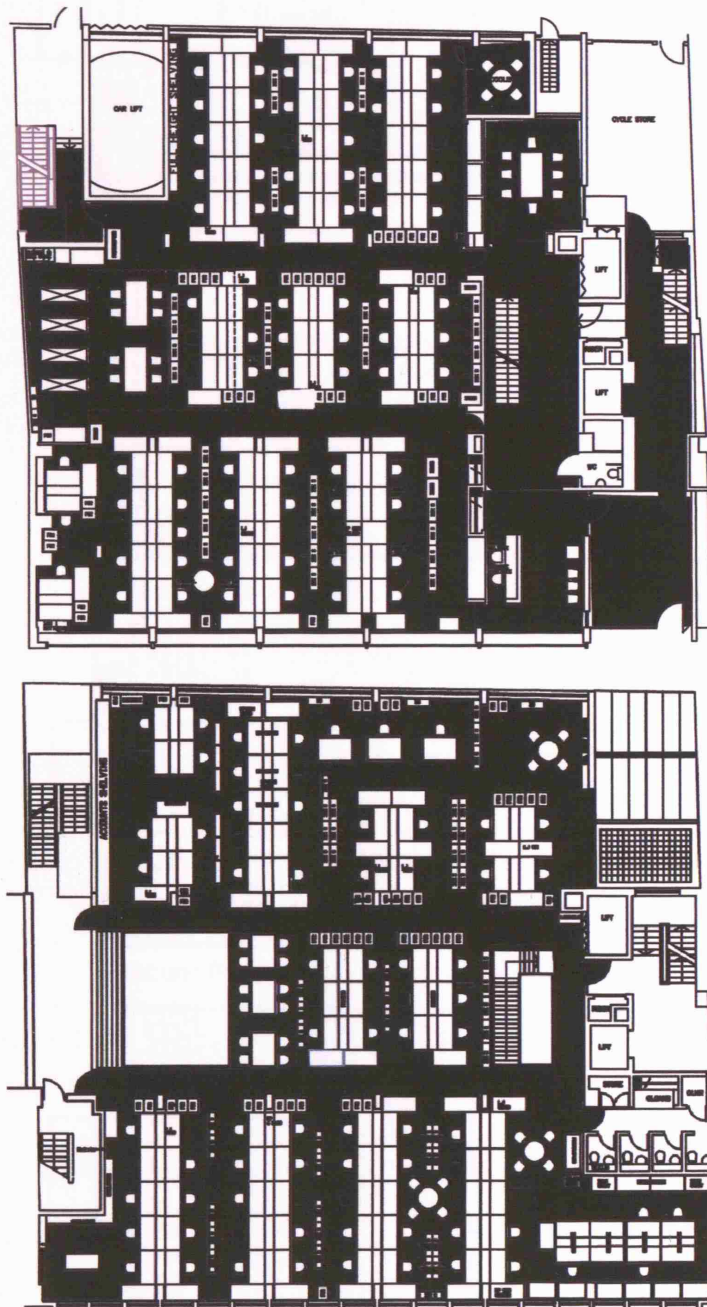
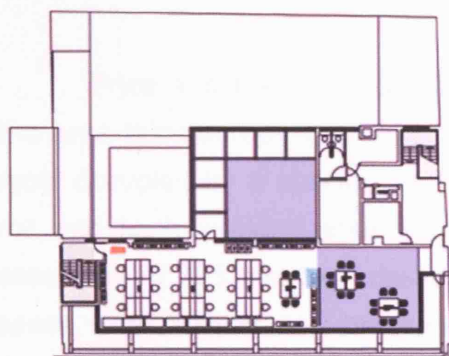
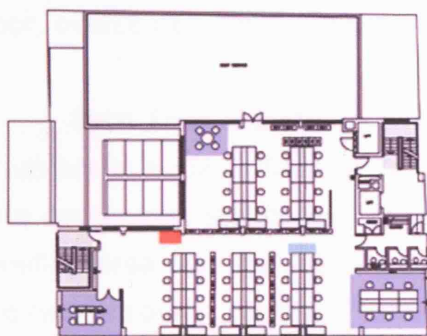


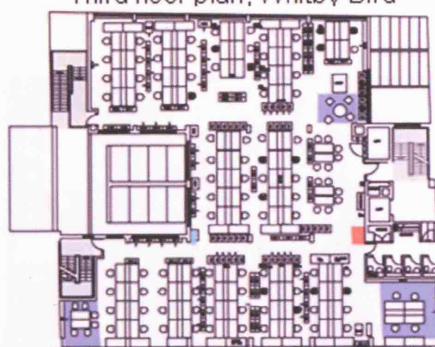
Figure 3.9 Nollie figures of Whitby Bird ground and First floor, illustrating building's shape and furniture placement



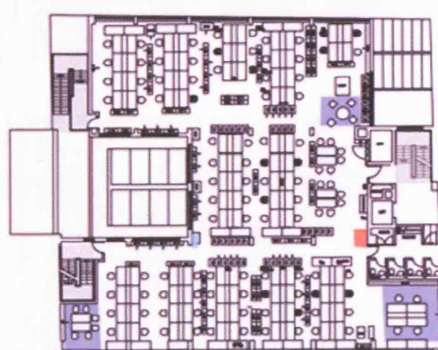
Fifth floor plan, Whitby Bird



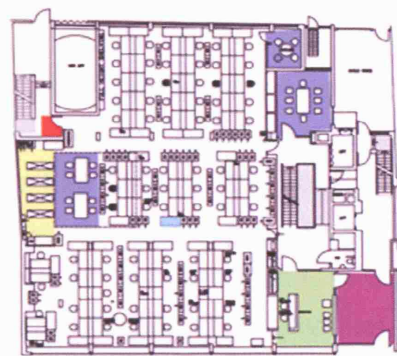
Third floor plan, Whitby Bird



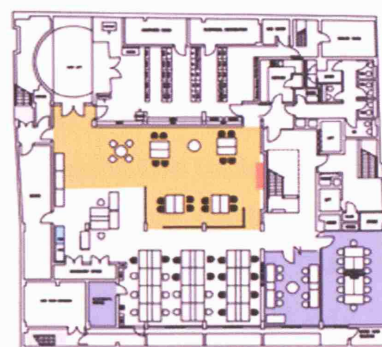
Second floor plan, Whitby Bird



First floor plan, Whitby Bird



Ground floor plan, Whitby Bird



Basement floor plan, Whitby Bird

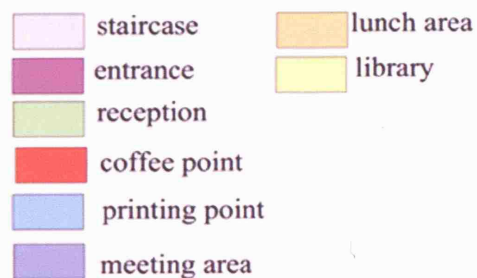


Figure 3.10 Whitby Bird functional map

Price and Myers London's office building is a parallelogram open plan, but the area they occupy is a rectangular one. The building consists of seven floors, most occupied by a specific working group. The total area of the building is 3,444 m² and each working area 150 m² on average. The floor patterns are similar, consisting of 725 mm high desks on the perimeter of the space, and, in the middle space, the partner and his secretary's desk are placed. The individual working space is 1.0 m² per employee. The placing of the desks around the perimeter of the floor, overcomes the dominance of the computer screens (Figure 3.11)

Each floor provides a small coffee room and a printing room. The storage areas are in a row in front of the partner's office, shaping the basic movement path. Two continuous staircases connect all the floors. The only cluster areas are one meeting area and the sustainability office located on the first floor. Other facilities are two balconies, on the 2nd and 5th floor, the kitchen, lunch area, leisure point and library in the basement, and post room on the ground floor (Figure 3.12).

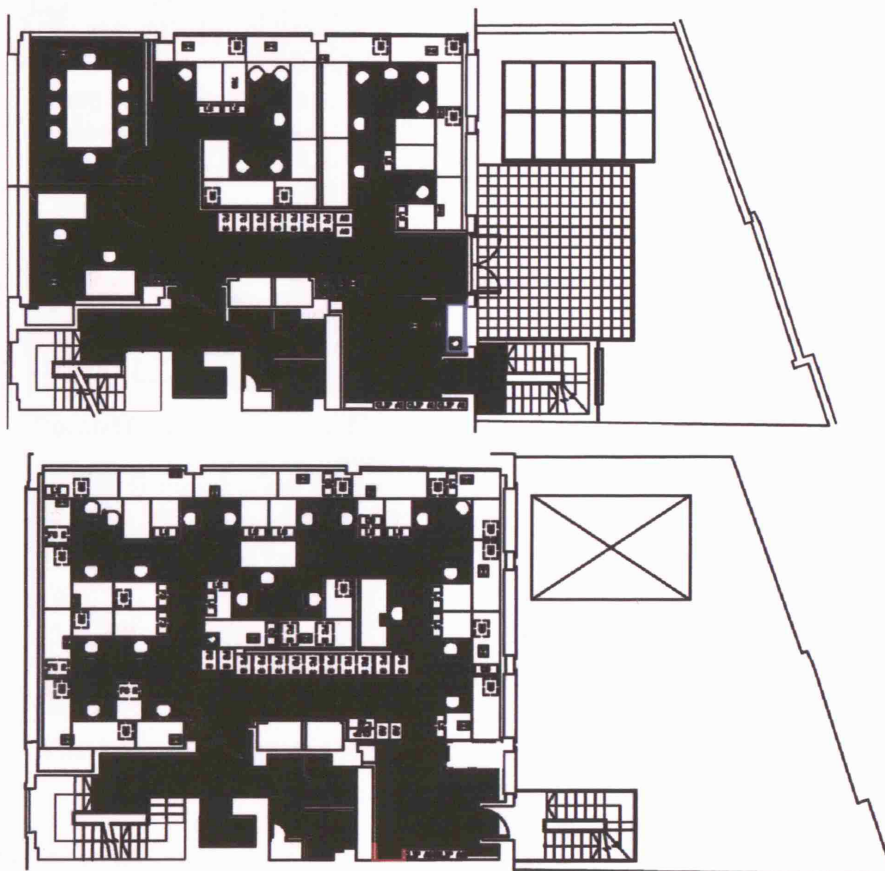
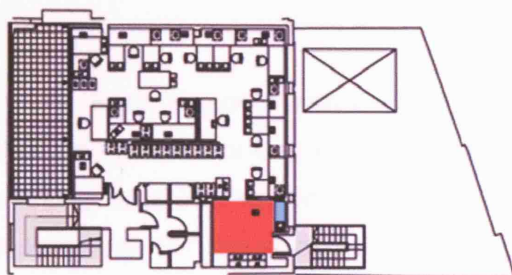
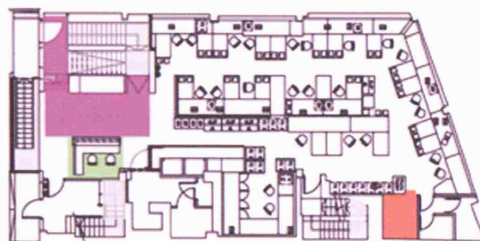


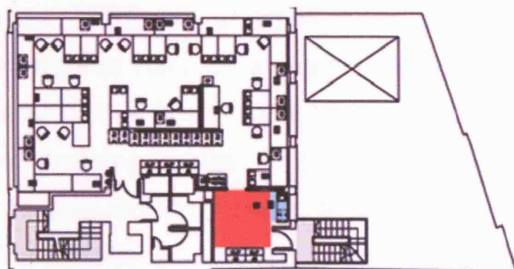
Figure 3.11 Nollie figures of Price and Myers First and Second floor, illustrating building's shape and furniture placement



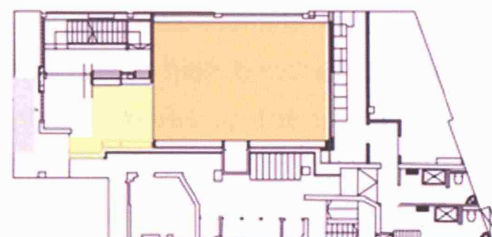
Fifth floor plan, Price and Myers



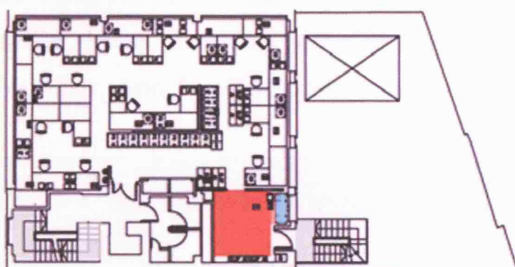
Ground floor plan, Price and Myers



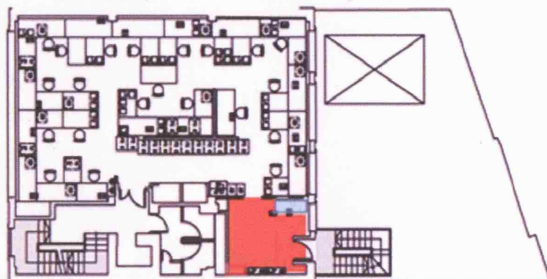
Forth floor plan, Price and Myers



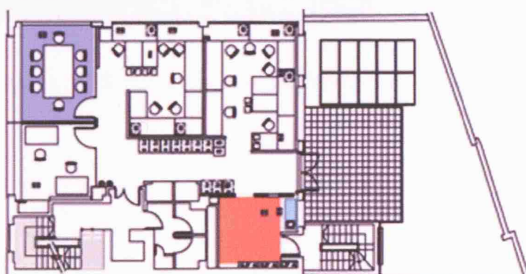
Basement floor plan, Price and Myers



Third floor plan, Price and Myers



Second floor plan, Price and Myers



First floor plan, Price and Myers

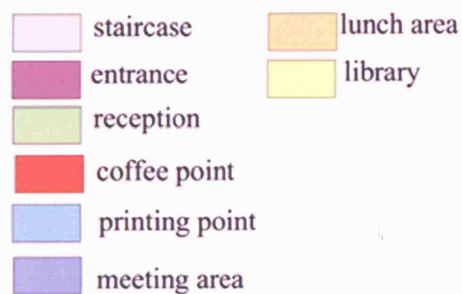


Figure 3.12 Price and Myers functional map

Buro Happold London's office building consists of four floors occupied by three different working groups. The total area of the building is 4,437 m² and the working area 350 m² on each floor. According to DBA, (2005), London's office was a prototype for the workplace design of Buro Happold's other office buildings. After observing people communication inside the workspaces, refurbishment started in early 2003, on a small area, to test the new design. The design of the new workplace has, as a main theme, the increase of discussion in the workplace. In general the floors have the same open plan pattern with high benches inspired by old drawing tables. The way the benches are placed breaks up the space, usually into two working areas, allowing small movable paths through and between them. The architects involved in the refurbishment argued that the height of the benches, at 1050 mm, brings the heads of seated people and standing colleagues to the same level, making possible to initiate useful discussions around a computer monitor, and facilitating conversational in general (Figure 3.13).

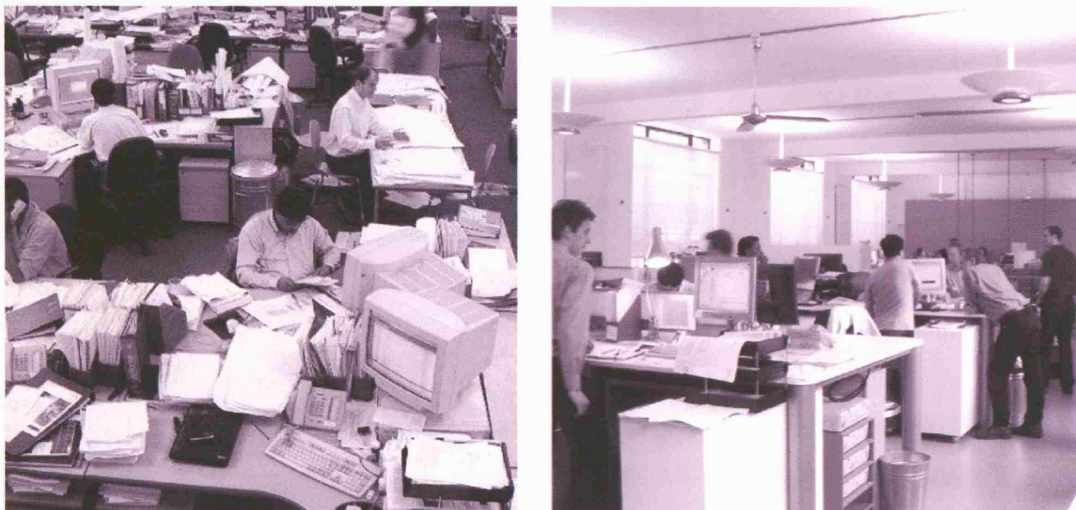


Figure 3.13 Burro Happold office building before and after the refurbishment, DBA, 2005

A new raised, open meeting space was designed at the back of the ground floor, recognising that the area was a focal point for anyone entering the main floor area. Most meeting areas are arranged around the edge of the floor plan, next to the windows and stairwells, surrounding the centrally-placed workbenches. Another feature of the refurbishment was the flat screens rear-mounted on movable brackets and posts, to save desk space and to improve visibility. The personal storage units, on wheels, were placed to make it easy for people to change seats, according to the needs of the project involved (Figure 3.14).



The key changes

- ① Work benches 1050mm high
- ② New chairs to match the high benches
- ③ Flat computer screens rear-mounted on movable posts and brackets
- ④ Computer racks at the ends of benches
- ⑤ Personal storage trolleys
- ⑥ Walls covered with perforated metal tiles to use for displaying drawings (attached with magnets) and as a projection screen
- ⑦ Sliding white boards with metal backs for sketching and displaying drawings
- ⑧ Meeting spaces
- ⑨ Hard linoleum instead of carpet
- ⑩ Layout tables for drawings (out of shot)

Figure 3.14 Buro Happold's office facilities, DBA, 2005

The new design facilitates the employees with 0.5 m² individual working spaces (Figure 3.15). Two main staircases link all the floors. The ground floor is connected to the basement with a small staircase and with the first floor from another point. The office building has a coffee area on the lower ground floor, as well as a library within it. A pub is found on the balcony of the first floor. Other facilities are small printing points, drawing tables and hot desking, found on most floors (Figure 3.16).

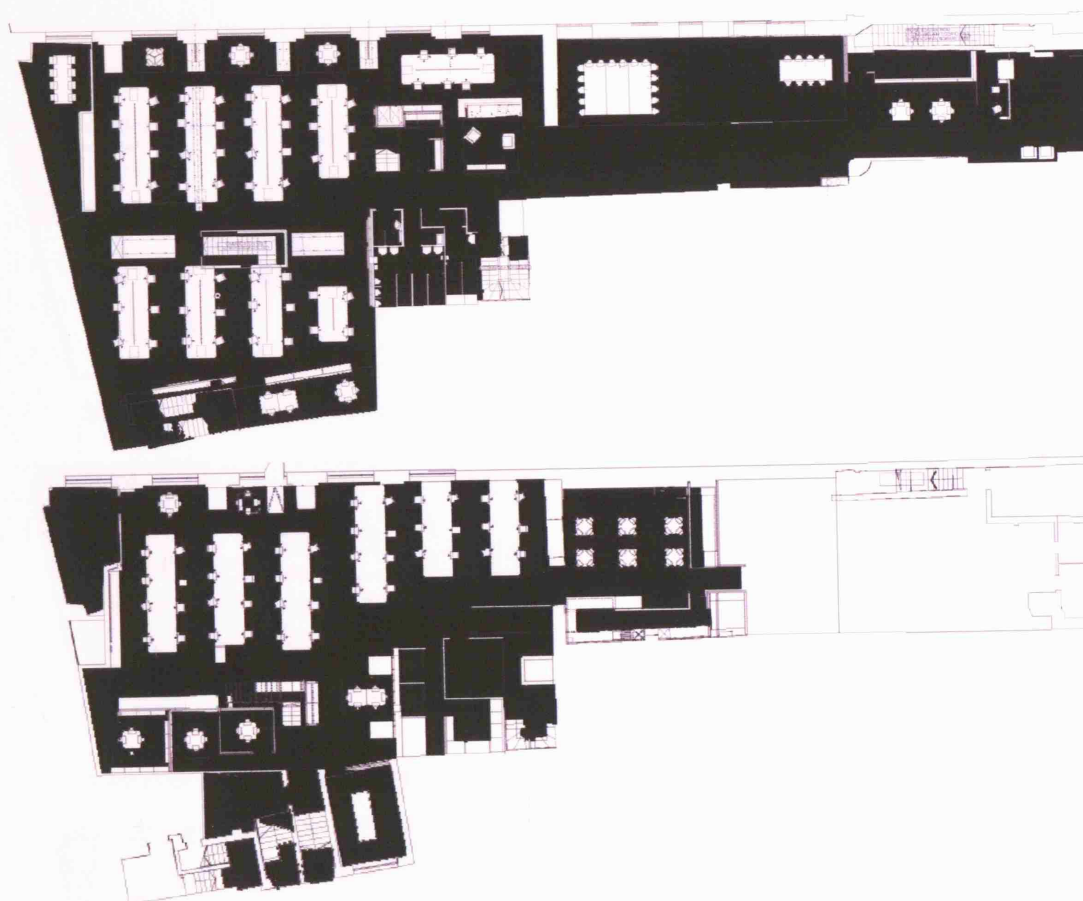
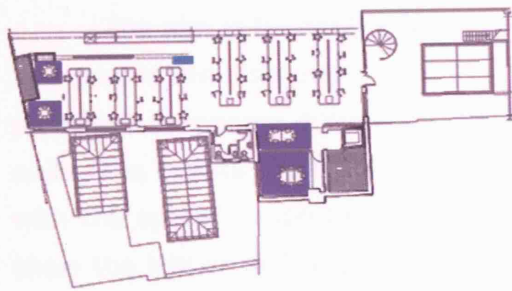
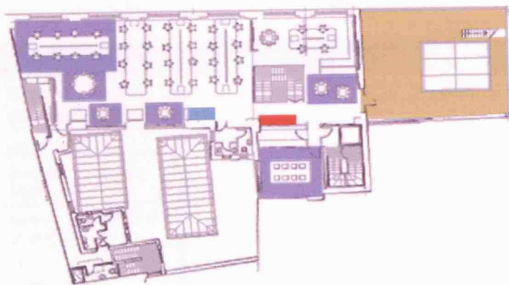


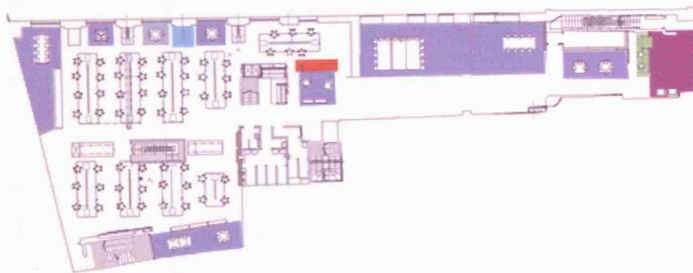
Figure 3.15 Nollie figures of Buro Happold lower ground and Ground floor, illustrating building's shape and furniture placement



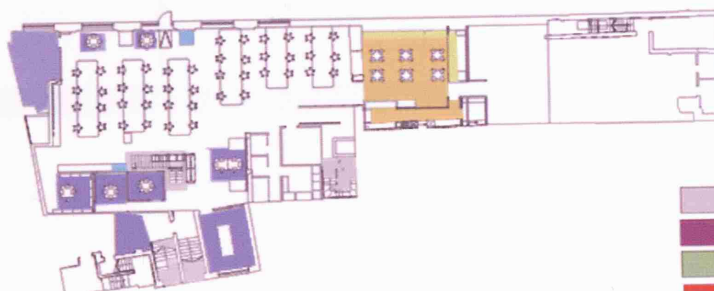
Second floor plan, Buro Happold



First floor plan, Buro Happold



Ground floor plan, Buro Happold



Lower ground floor plan, Buro Happold









- | | |
|---|--|
|  staircase |  lunch area |
|  entrance |  library |
|  reception | |
|  coffee point | |
|  printing point | |
|  meeting area | |

Figure 3.16 Buro Happold functional map

3.3 Group Separation and People Distribution

The aim is to identify how groups are organised inside the working area and how people are distributed according to their role and status (Table 3.4). The maps produced on people occupancy present the socio-spatial contracts within working units. The results are of importance as individual and group position in comparison with the spatial properties, the social networks and the management models, will show the labour division as well as the relationships between, and within, working groups

| | Whitby Bird | Price and Myers | Buro Happold |
|--|---|---|--|
| Group classification | | | |
| group types | special groups | partner permanent groups | business integrated groups |
| number of groups in total | 21 | 5 | 3 |
| number of groups in the studied floors | 3 in the ground floor+8 in the first floor | 1 in the first and second floor | 1 in the lower ground and ground floor |
| groups identity | structural engineering teams(2 teams in the ground+1 team in the 1st floor) secretarial team ground floor) facades team(1st floor) partners team (1st floor) human resources team(1st floor) finance team (1st floor) management team (1st floor) bridges team (1st floor) administration team 1st floor) | structural engineering team (1 in the first and second floor) | structural engineering team (1 in the lower ground and ground floor) |
| group organisation | group directors associates senior associated engineers senior engineers draftsmen Students secretary | group managers partners associates engineers Draftsmen Secretary | partners associates engineers draftsmen secretary |

Table 3.4 Group classification

Reviewing the above table Whitby Bird's work force is 260 people, but this project will focus on the ground (51 employees) and the first floor (54 employees). The two floors consist of 11 working groups in total (3 and 8 respectively). On the ground floor three teams are located, with the two bigger teams being structural engineering groups. The third is the secretary team. On the first floor there are seven teams in total (human resources, administration, finance, management, facades, structural engineers, bridges). The working staffs is distributed in small permanent work teams and occupy specific workplaces, creating constant socio-spatial contracts according to their work demands. Group directors and associates create random socio-spatial contracts, seating in a loose way in their group space (Figure 3.17).

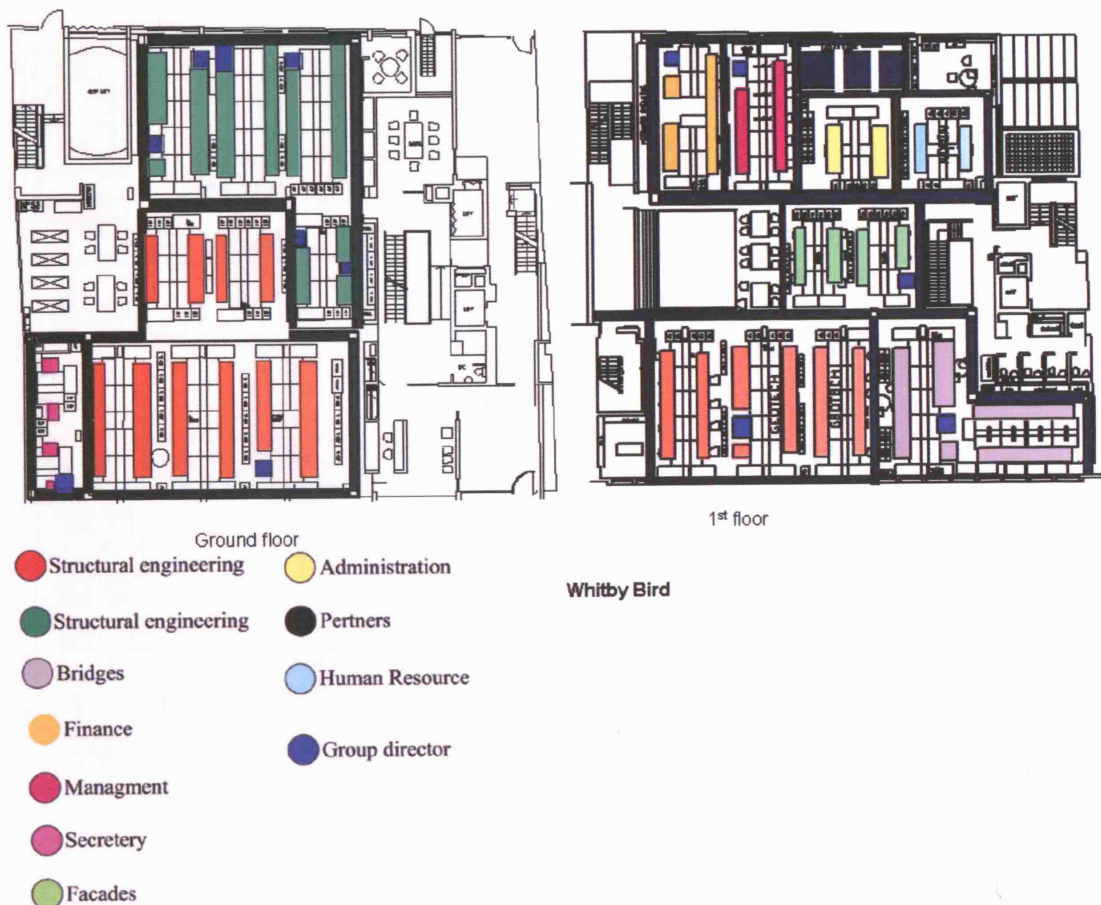


Figure 3.17 Whitby Bird working groups division

In Price and Myers the distributional pattern is similar. The study focuses on the first and second floors. The team studied has increased in size over the last two years, doubling in membership to become twice the normal size, thus requiring two floors. Price and Myers office building in London accommodates 135 people in total, with 35 being members of the group studied. Each floor houses an engineering team, organised on the periphery of the floor area. The team is led by a partner and an associate. Partners are seated at the front desk, near to their secretary, with associates on the edges of the floor area, creating steady and hierarchical-dependent socio-spatial contracts. Both floors belong to the same working group, and collaborate on the same projects. Other team members (engineers, draftsmen) create random but constant socio-spatial contracts from permanent desks selected randomly (Figure 3.18).



Figure 3.18 Price and Myers working groups division

In the Buro Happold office IBG1 (integrated business group) is spread across the lower ground and ground floor, accommodating 90 people in total. The first floor is occupied by IBG2 and the second floor by the design team. The total work force in the building is 164 people. This thesis focuses on the IBG1 group, as it is the biggest group in the London office and is presently involved in more than 12 projects. The group is subdivided into smaller groups that frequently change membership and seats according to project changes, creating strategic project-base socio-spatial contracts. Group directors and associates are placed all over the floor area to direct all the IBG1 subgroups. The main directors are under the staircase on the ground floor for privacy and noise protection. It can be argued that partners' and associates' seats are developing strategic socio-spatial contracts (Figure 3.19)

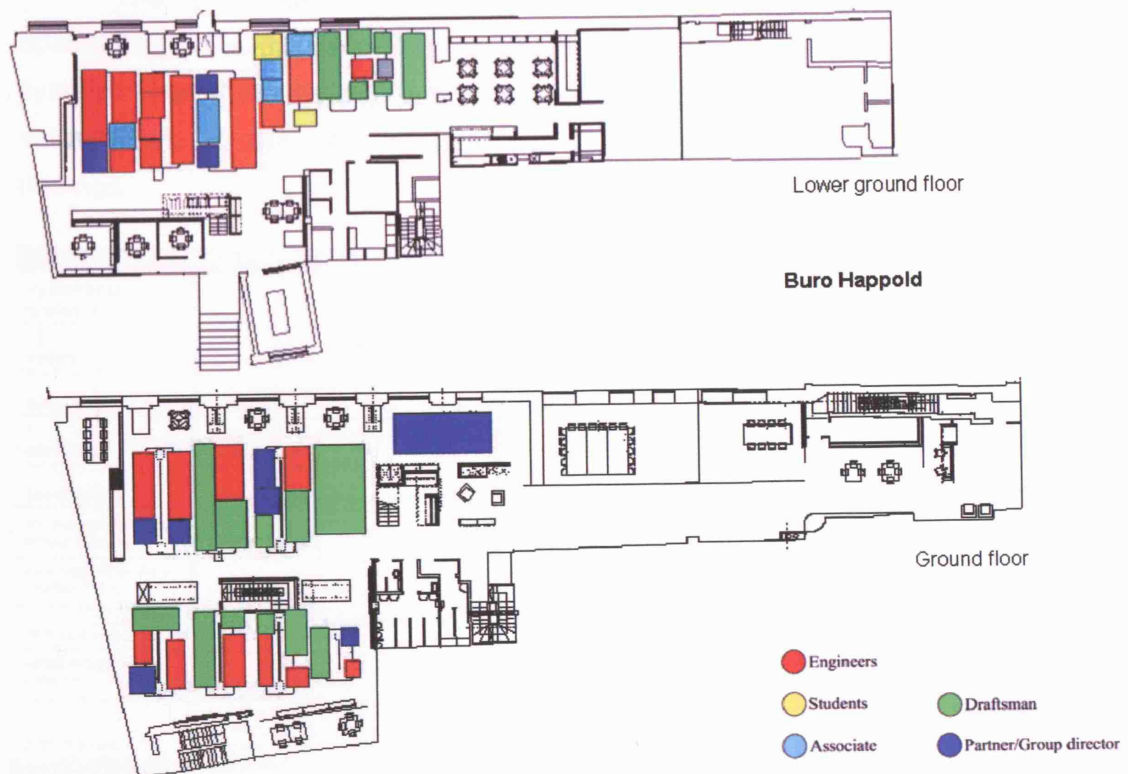


Figure 3.19 Buro Happold working groups division

Introduction

As managerial features, built environment characteristics, and groups' classification have been described, the syntactical analysis and observational survey is explored. The purpose of the methodology chapter is to identify spatial and social office systems and to study the organisation-accommodation relationships between, and within, groups. This chapter focuses on the analysis components of the study, and is associated with three different office buildings, investigates different types of office activities demanding different spatial concepts. How similar organisations, with different spatial systems, create relationships within, and between, the same, and different, work groups?

The syntactical findings are presented in Table 4.1, so as to observe where spatial properties are over-layered, or where spatial properties are embedded in the system. Spatial mismatches are of major interest since spatial features have social values that, in the next session, are explored, and compared, with observed findings.

| | Whitby Bird | Price and Myers | Euro Happold |
|--|--|--|---|
| syntactical analysis | | | |
| visibility | visual integrated fields in the work spaces | visual integrated workspace | visual integrated cores in specific parts of the workspace |
| accessibility | 2 accessed corridors through the workspaces | accessible routs all over the workspaces+ office facilities | one access rout along with the building's corridor but not through the workplaces |
| all line map | 2 integrated movements paths along the main corridors | integrated movements pattern around work spaces | one integrated movement path along the main corridor |
| convex spaces | most integrated spaces are the corridors | most integrated spaces are the corridors | most integrated spaces are corridors that drive to facility cores |
| convex spaces with and without furniture | furniture do not change integrated spaces | furniture do not change integrated spaces | furniture change the integrated spaces and create integrated desk spaces |
| axial map of the whole building | Global integrated corridors | Global integrated staircases | Global integrated lines through the workplaces and facility cores |
| local axial map | local integrated corridors through the work space | local integrated corridors all over the workplace | local integrated lines in the facility cores |
| spatial integrated systems | local integrated system | local integrated system | global integrated system |
| justified graphs | workplaces are located 4 steps deep from the main entrance till 7 steps-riny structure | workplaces are located 3 steps from the main entrance till 12 steps-riny structure | workplaces are located 1 step from the entrance till 11 steps-bush structure |

4.1 The Analytical Model

The analytical model specifies knowledge needed to study space; the aim is to identify the analytical knowledge of architectural design and how it has to be treated to study its spatiality and social meanings.

In the literature review, it is argued that the social construct is mediated by spatial laws, and that the potential use of space and its spatial features affect social use (Hanson and Hillier, 1984). In terms of the relationship between movements and encounters there is a difference between local and global space. Penn, Desyllas and Vaughn (1999) argue that the relationship between the local and the global is of great importance. They find that on the local scale encounters happen through space proximity, while encounters over distance are quite different, and need a far greater degree of conceptual organisation. There are two kinds of distance; real distance and social distance. On the micro-scale of an office building encounters over real distance are the interactions between people placed on different floors, while encounters over a social distance are the contacts between people with different knowledge and roles, or between people that belong to different work units.

Accepting that office organizations work like societies, and that social distance relations are shaped through different work tasks and roles; socio-spatial contracts, Hillier and Hanson (1984) argue that social categories are unique in different spaces. This is a fundamental issue in understanding the differences on the structure and distribution of work groups and the work places they occupy. To classify group social divisions, Durkheim's argument is fundamental. *'Social life comes from a double source, the likeness of consciences and the division of social labor'* (1933, p.226). Durkheim argues that there are two different patterns of force that integrate different segments of a society; mechanical and organic solidarity. Mechanical solidarity applies to societies in which all members have common and shared social experiences, with special sub-divisions within a society either absent or weak. Organic solidarity societies are formed by a system of different organs, each of which has a specific role and tasks, and they depend on each other to live in the society.

On this distinction and aiming to capture the knowledge aspect on the efficient transaction of social knowledge into space, long and short modes are introduced. Hillier (1996) defines the difference between 'long' and 'short' as the number of rules that can be imposed on the movement of a body through the spatial configuration. While the long model refers to the routine, ritual-like

movement imposed by space; the short model describes the maximising of the random encounters of a body by space. In this sense *'architectural design can be considered as the construction of potential spatial relations that can be appropriated for specific social acts thus become meaningful to those involved'* (Penn, 2005, p.2).

4.2 The Spatial System

Seeing space as an analytical model, the idea that the relation between movements and encounter is differentiated according to local and global spaces is adopted. Local and global spatial patterning is analysed using the Space Syntax tools, with space syntax terms explained in Glossary-Terminology, 8.0 (p.96).

4.2.1 Local System

The objective of searching for similarities and differences in different activities and different workspaces leads to Hillier and Penn's (1991) argument that the patterns of space in building interiors affect group interaction patterns.

Concentrating on the local scale of the office buildings – the floors studied – the first strategy is to develop an all line map to identify the pattern of linear and segmental movements. All line axial maps basically pick up all the potentials for movement, using the vertex of each built form modelled. The results reflect the fundamental relationships between the configuration of the furnished space and movements (Figure 4.1, 4.2, 4.3).

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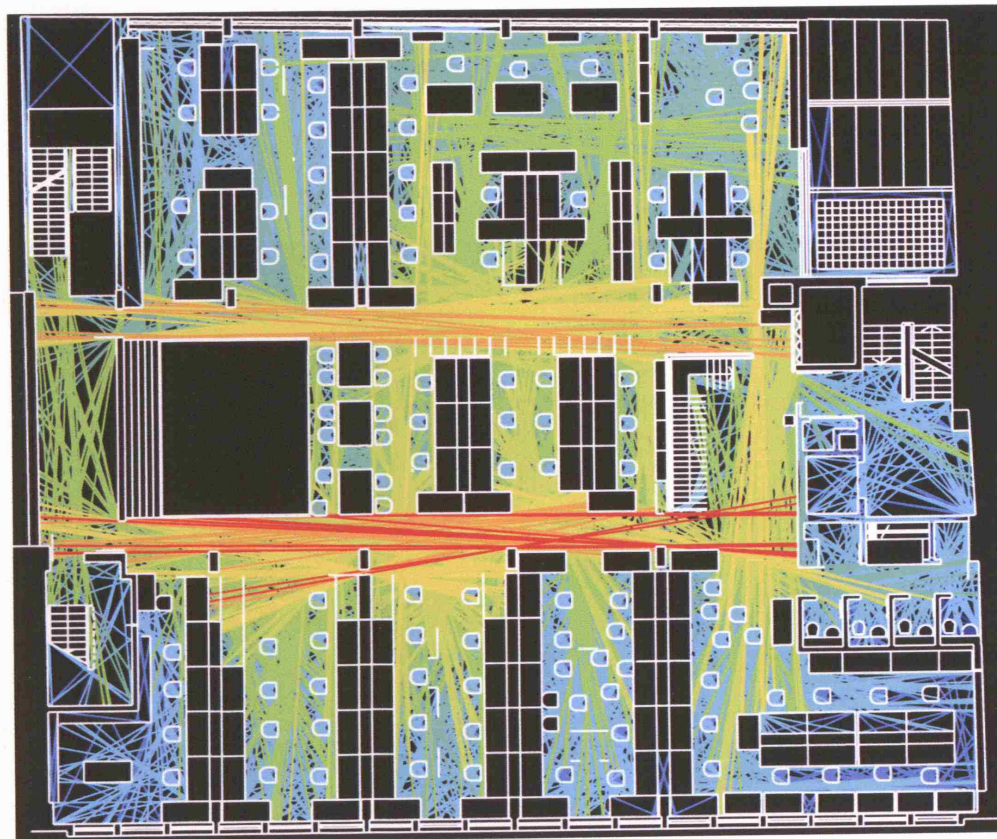
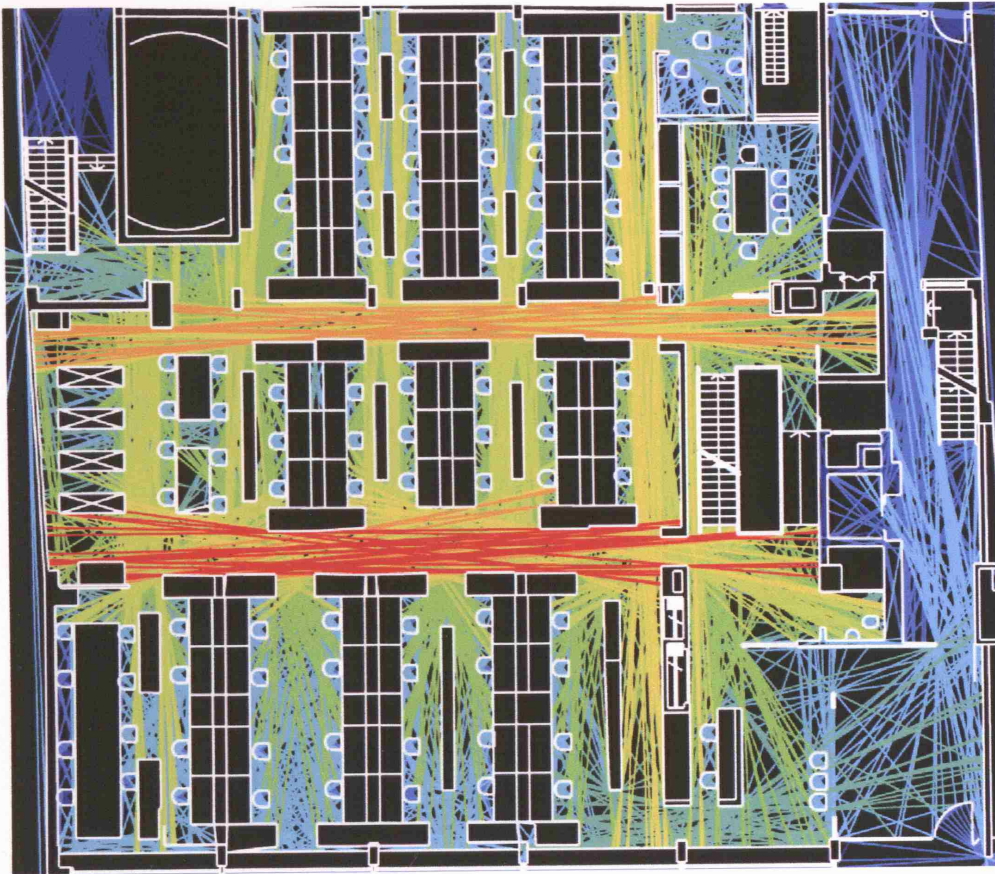
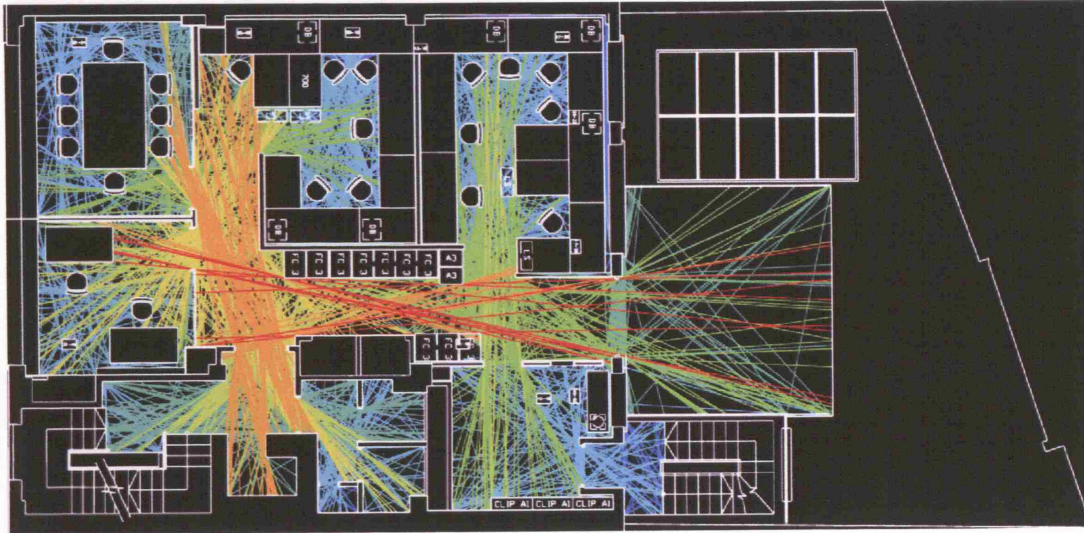


Figure 4.1 Whitby Bird ground and first floor all line maps



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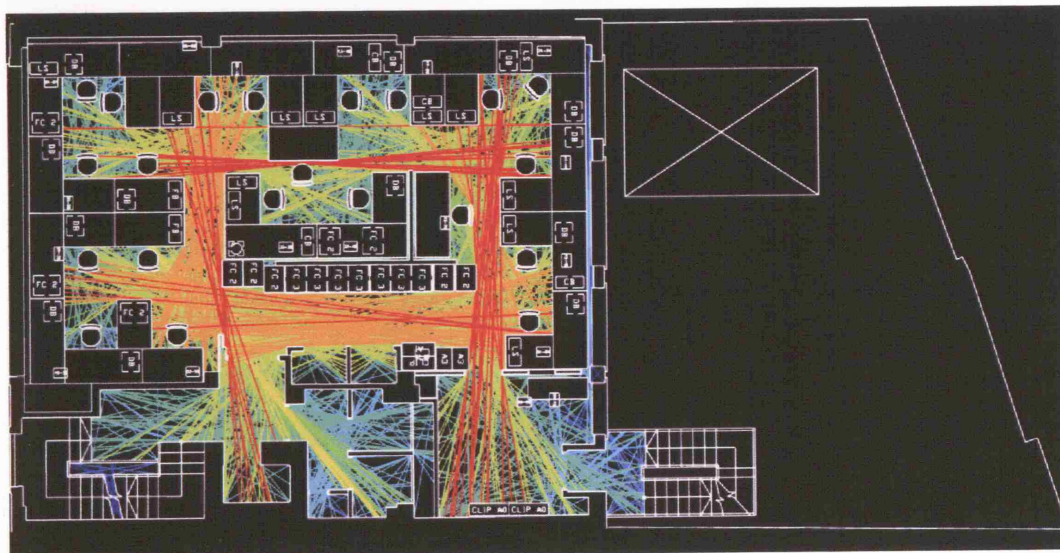


Figure 4.2 Price and Myers first and second floor all line maps



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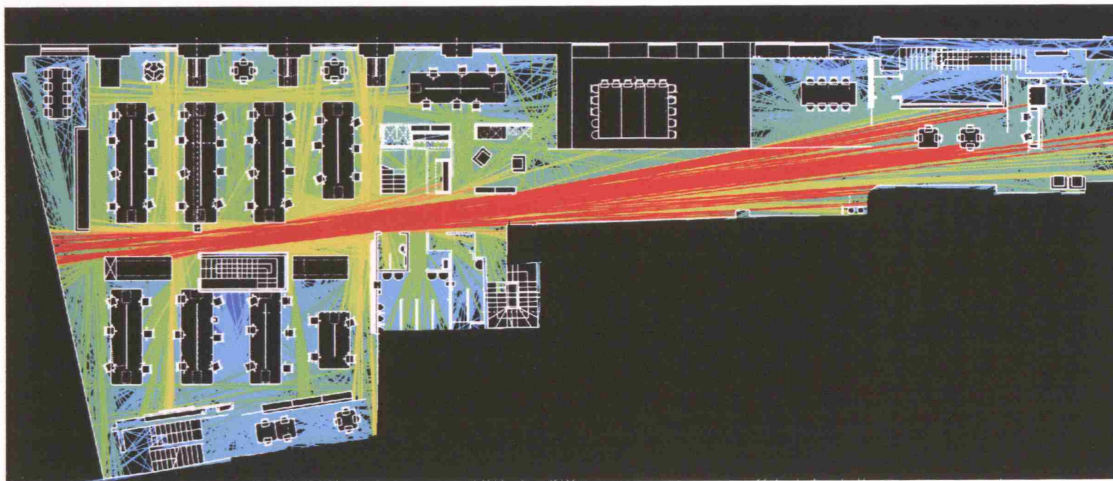


Figure 4.3 Buro Happold lower ground and ground floor all line maps

It is observed that at Whitby Bird (Figure 4.1), the spatial system creates two integrated flows of movement, specifically in the two corridors that divide the floor area into three work places. Linear and segmental movements inside the work areas are weak, as office furniture, and specifically the storage boxes, create movement barriers. In the Price and Myers office building the spatial layout creates linked movements around the work place (Figure 4.2). This can mostly be observed on the second floor where the plan layout allows circular movements through the work place. In the Buro Happold case movements are integrated along the basic route of the floor, passing in between the two work areas (Figure 4.3).

The visible and accessible patterns of space are analysed to obtain the degree of axial and segment movements following accessible and visible paths (Figure 4.4, 4.5, 4.6, 4.7, 4.8, 4.9).

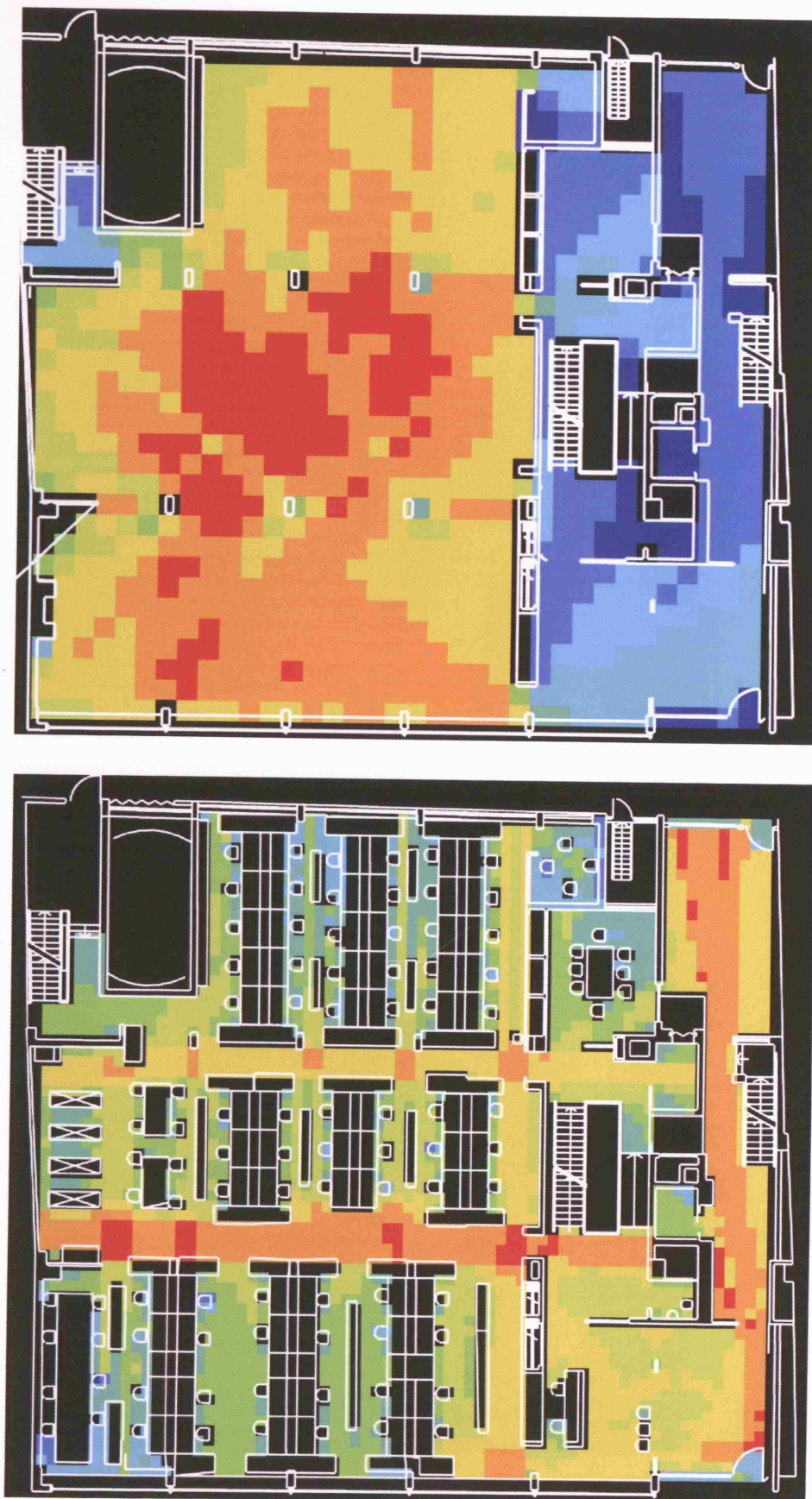


Figure 4.4 Whitby Bird ground floor visibility and accessibility analysis

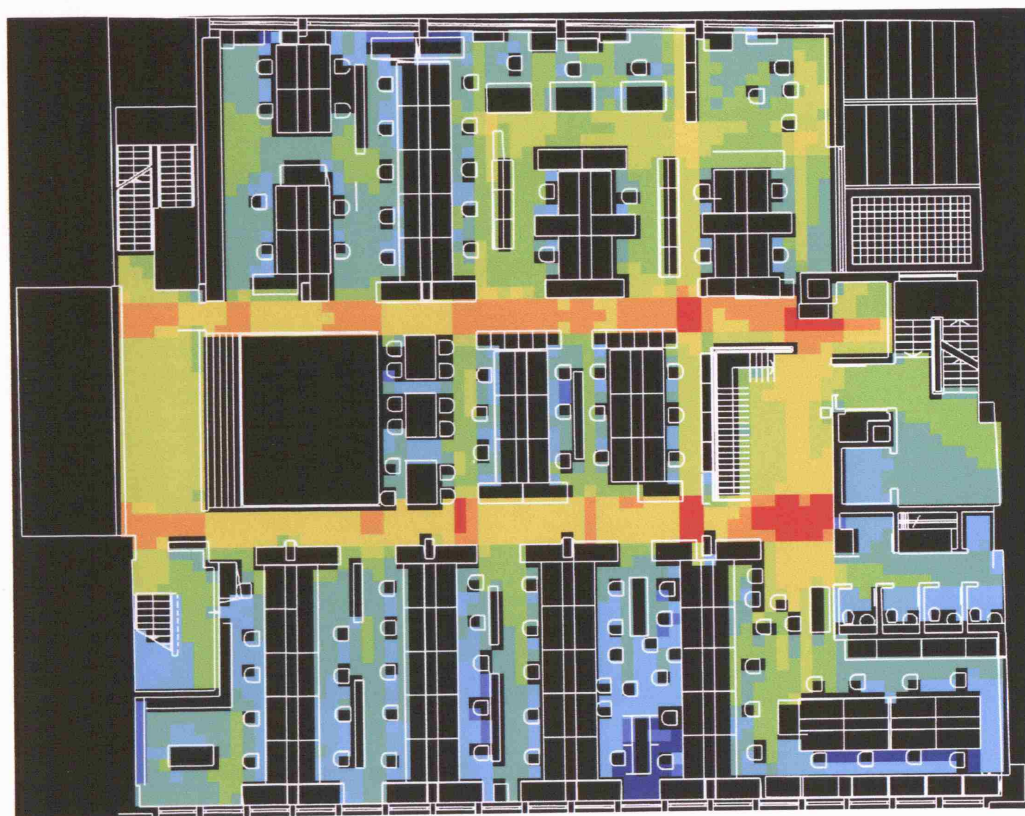
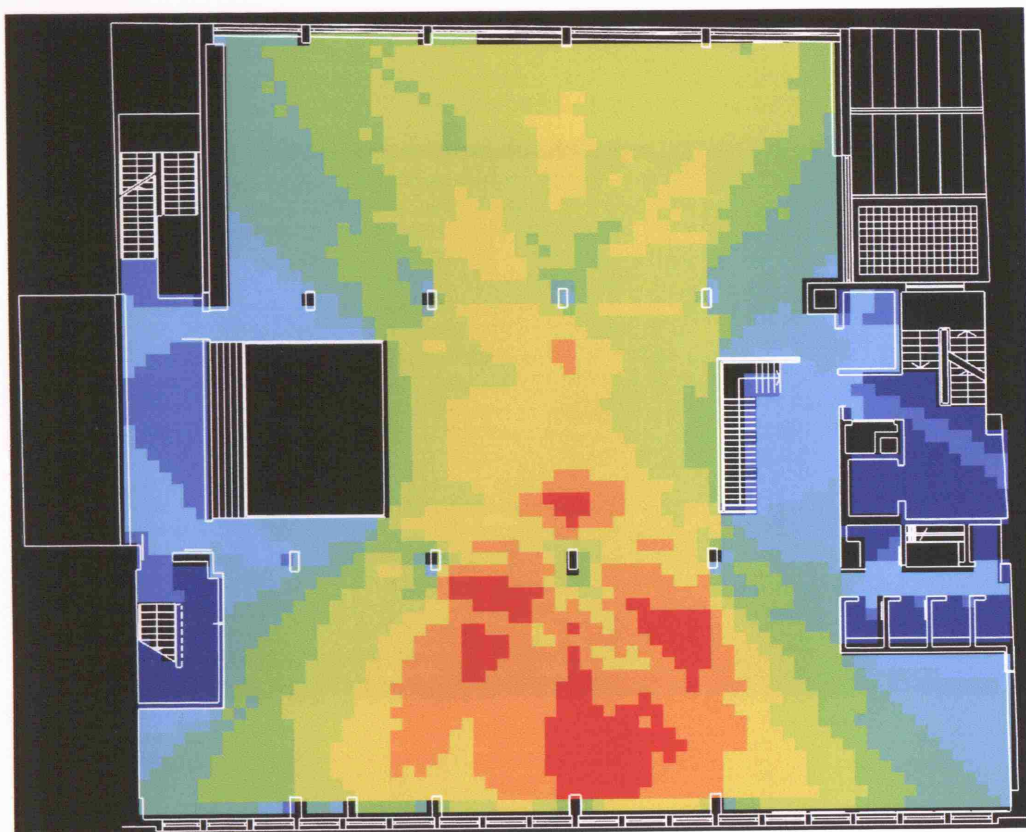


Figure 4.5 Whitby Bird first floor visibility and accessibility analysis

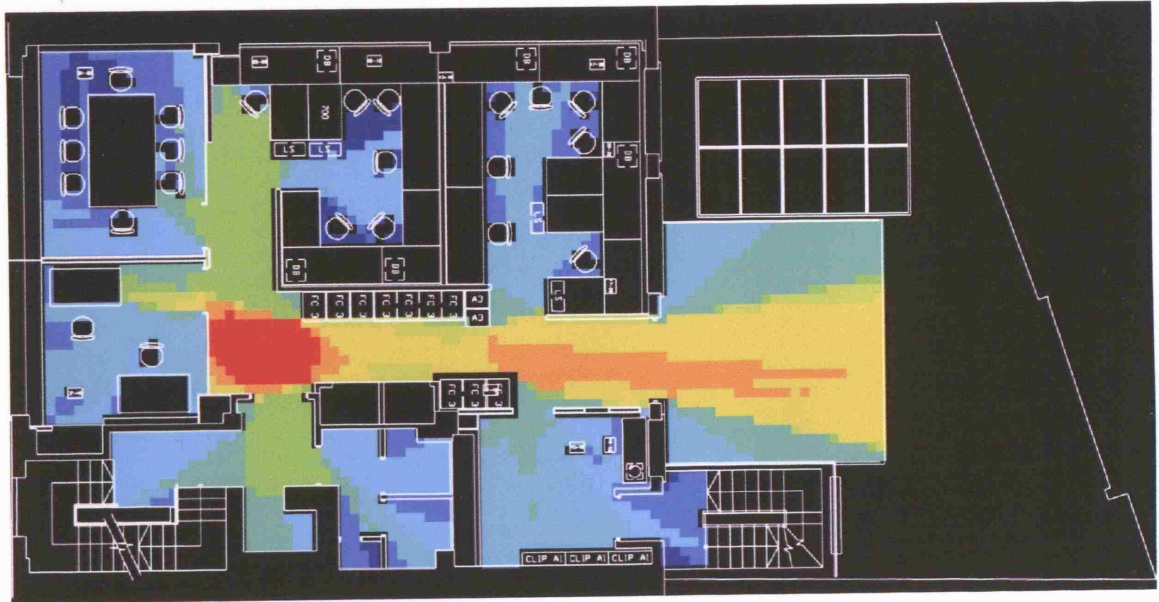
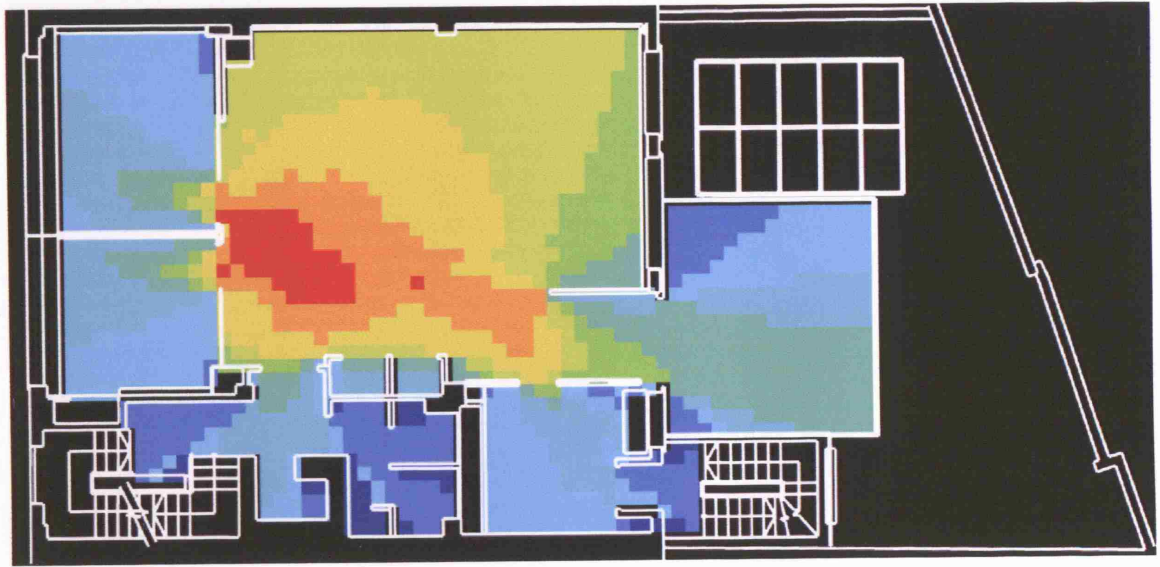
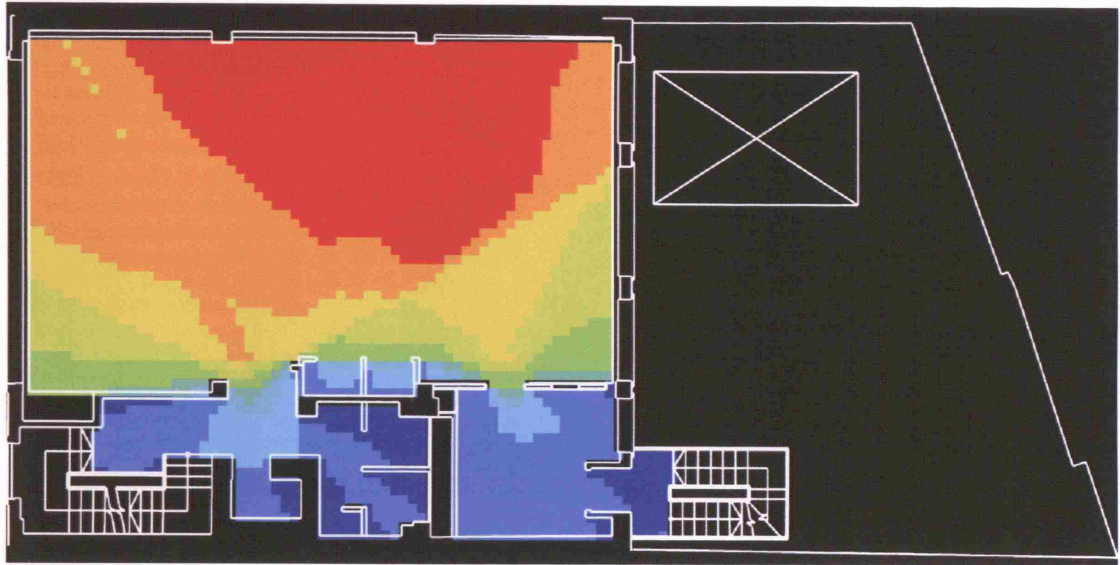


Figure 4.6 Price and Myers first floor visibility and accessibility analysis



51

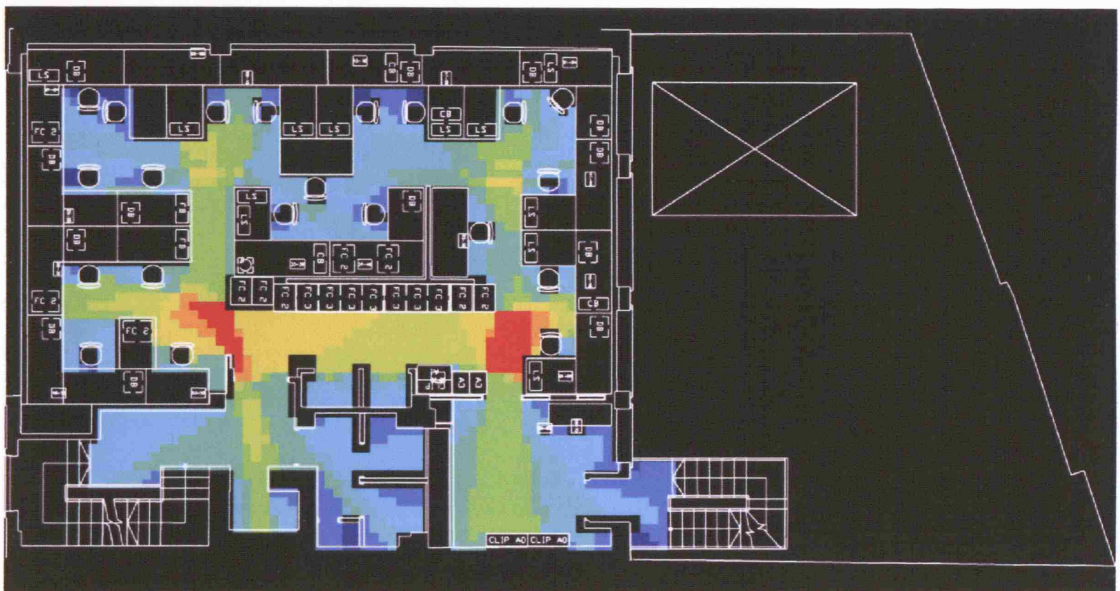
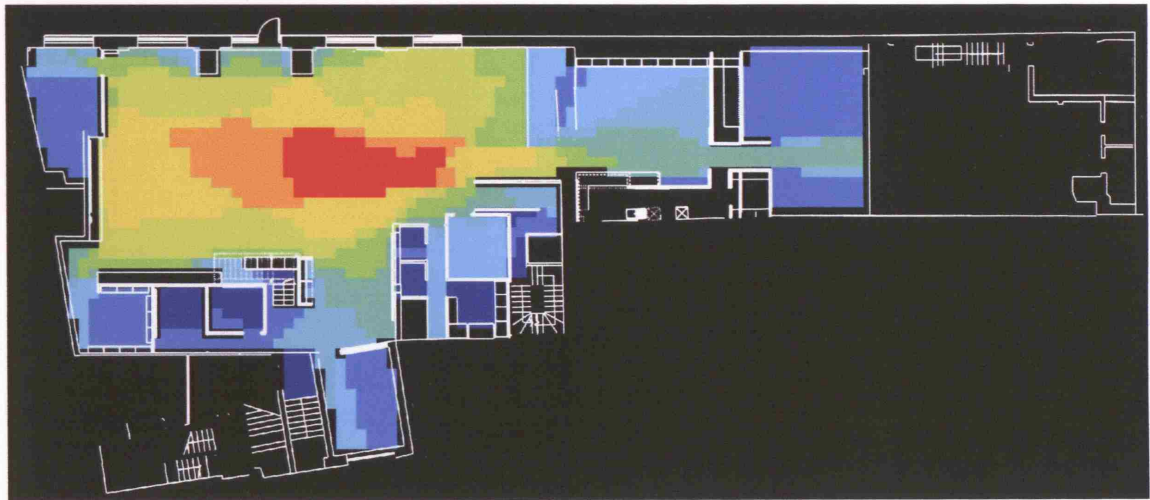


Figure 4.7 Price and Myers second floor visibility and accessibility analysis



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Figure 4.8 Buro Happold lower ground floor visibility and accessibility analysis

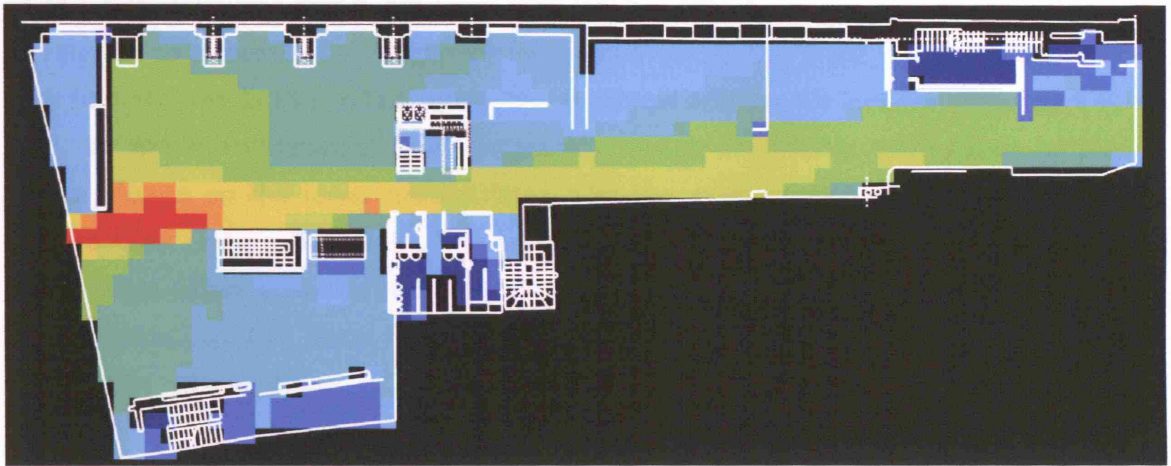


Figure 4.9 Buro Happold Iground floor visibility and accessibility analysis

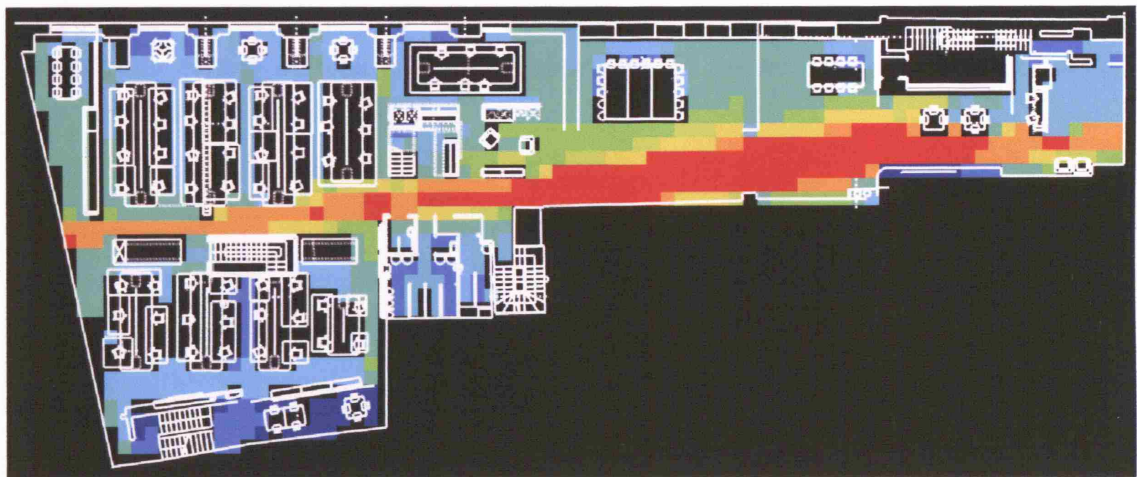


Figure 4.9 Buro Happold Iground floor visibility and accessibility analysis

The visibility graph of the Whitby Bird office building indicates visible fields inside the work area. The accessibility graph on the ground and first floor finds the two basic corridors the most accessible (Figures 4.4, 4.5). The visibility graph analysis of Price and Myers indicates that visual paths occur all over the two floors in relation to accessibility properties integrated inside the work space. Access can also be observed in the coffee space, the staircase and the lift location (Figures 4.6, 4.7). In the Buro Happold case, accessible routes are visibly segregated as the coffee area is on the lower ground floor, and the meeting/common area is on the ground floor (Figure 4.8, 4.9). It is concluded that axial and segmental integrated movements follow visibility and accessibility routes in the Whitby Bird and Price and Myers cases. In the Buro Happold case axial and segmental integration is not compatible with visibility.

Observing visibility and accessibility compared to linear and segmental movements, it is interesting to focus on space partitioning. Are the work areas integrated enough to provide movements patterns from one to the other in the order people meet? Is spatial control encountered in the way space is divided? The strategy is to divide the studied floors into more or less convex spaces defined by work stations and partitions. Just as one movement route passes through a number of spaces, any convex space may have a greater, or lesser, number of available routes going into it. The number of other spaces linked directly to a space by axial lines will differ, depending on how strategic the available lines are. As such the accessibility of any convex space can be measured by its integration (figure 4.10, 4.11, 4.12, 4.13, 4.14, 4.15).

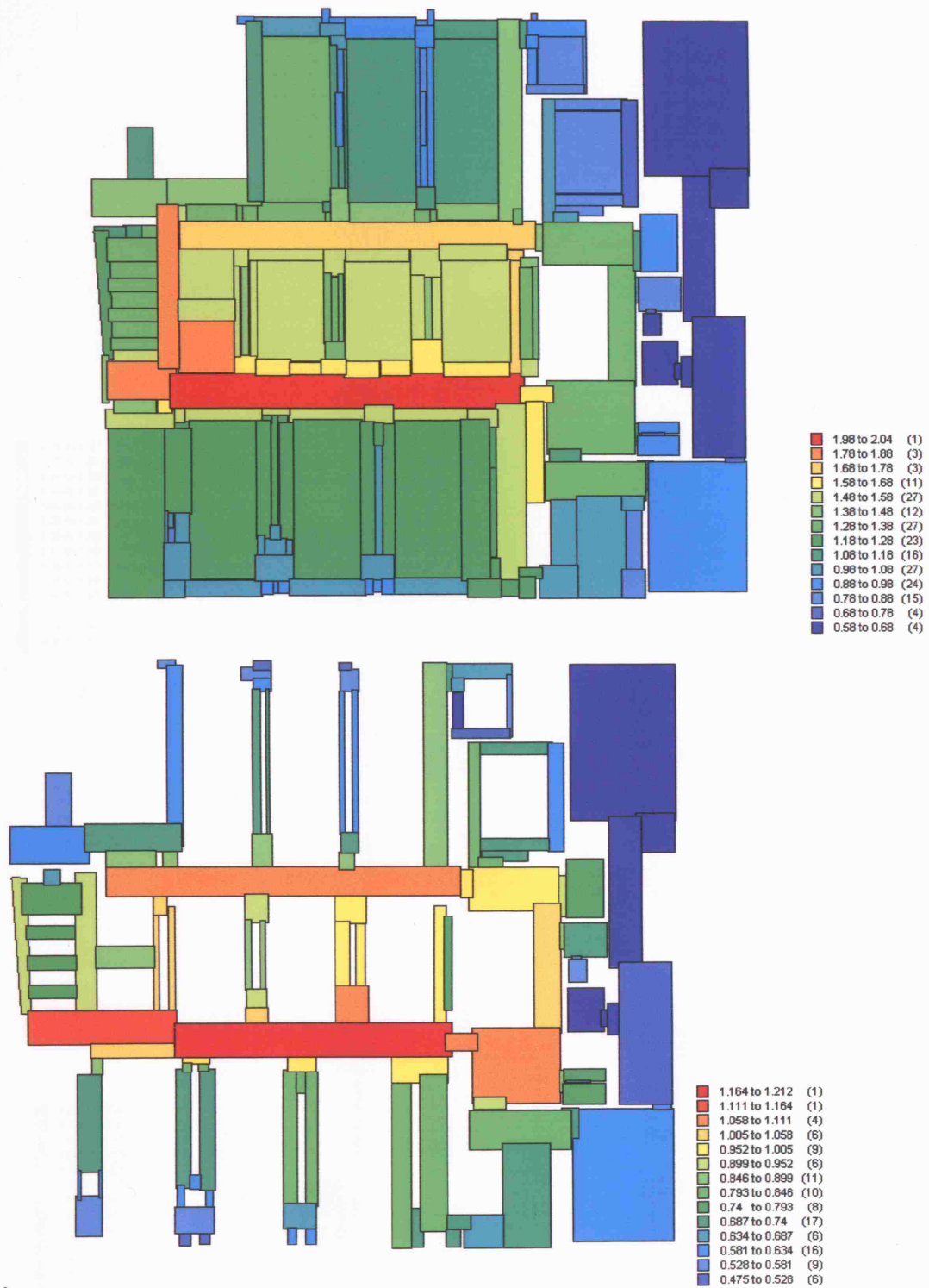


Figure 4.10 Whitby Bird ground floor convex maps with and without the office furniture

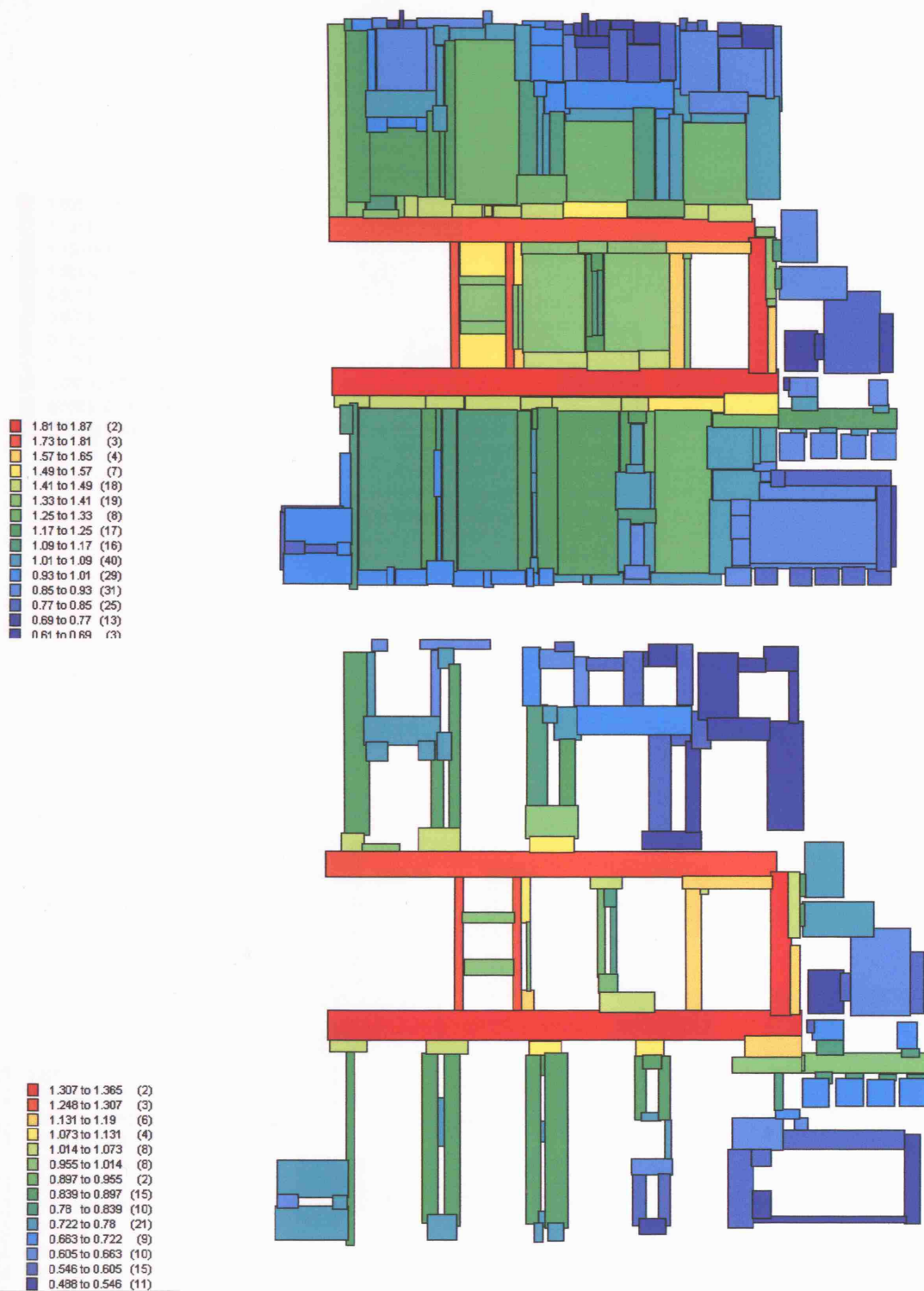
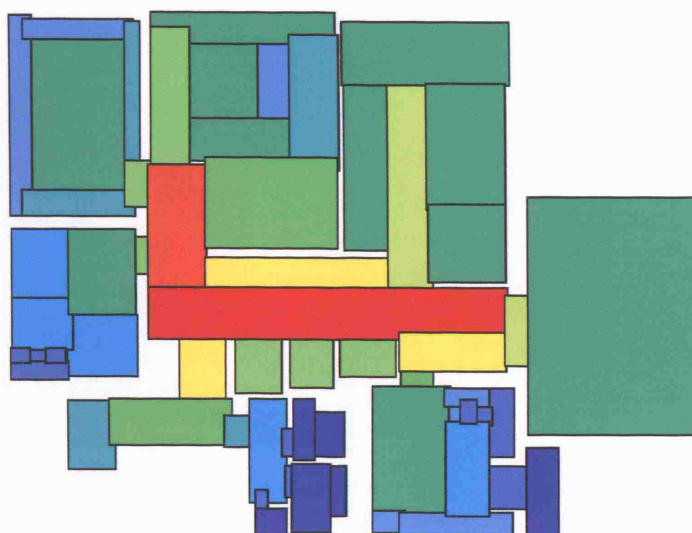


Figure 4.11 Whitby Bird first floor convex maps with and without the office furniture

- 1.608 to 1.689 (2)
- 1.233 to 1.308 (3)
- 1.158 to 1.233 (3)
- 1.083 to 1.158 (3)
- 0.933 to 1.008 (1)
- 0.858 to 0.933 (7)
- 0.783 to 0.858 (5)
- 0.708 to 0.783 (2)
- 0.633 to 0.708 (5)
- 0.558 to 0.633 (3)
- 0.483 to 0.558 (1)



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- 1.075 to 1.114 (1)
- 0.985 to 1.03 (1)
- 0.94 to 0.985 (1)
- 0.895 to 0.94 (1)
- 0.85 to 0.895 (1)
- 0.805 to 0.85 (3)
- 0.76 to 0.805 (3)
- 0.715 to 0.76 (1)
- 0.67 to 0.715 (2)
- 0.625 to 0.67 (7)
- 0.535 to 0.58 (8)

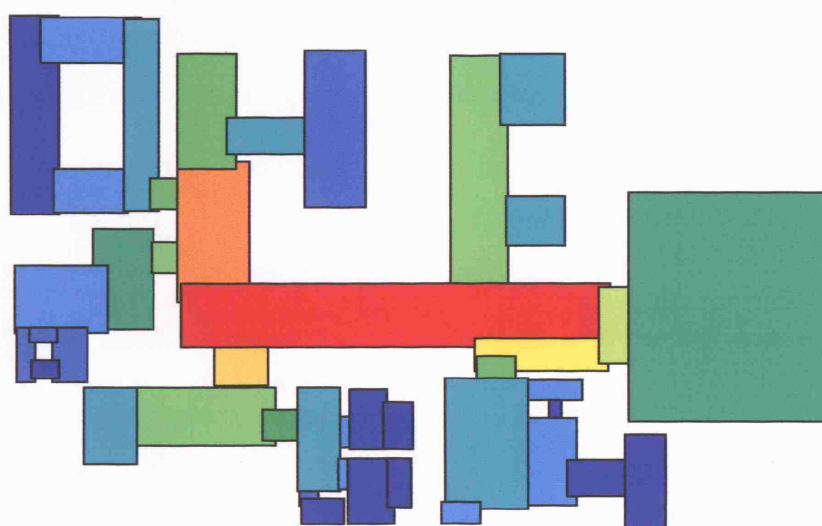


Figure 4.12 Price and Myers first floor convex maps with and without the office furniture

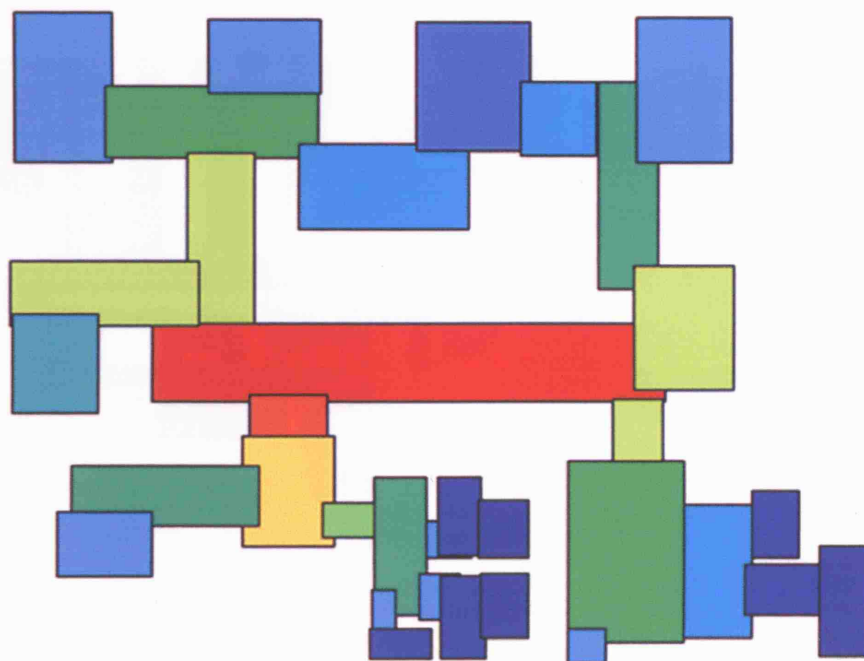
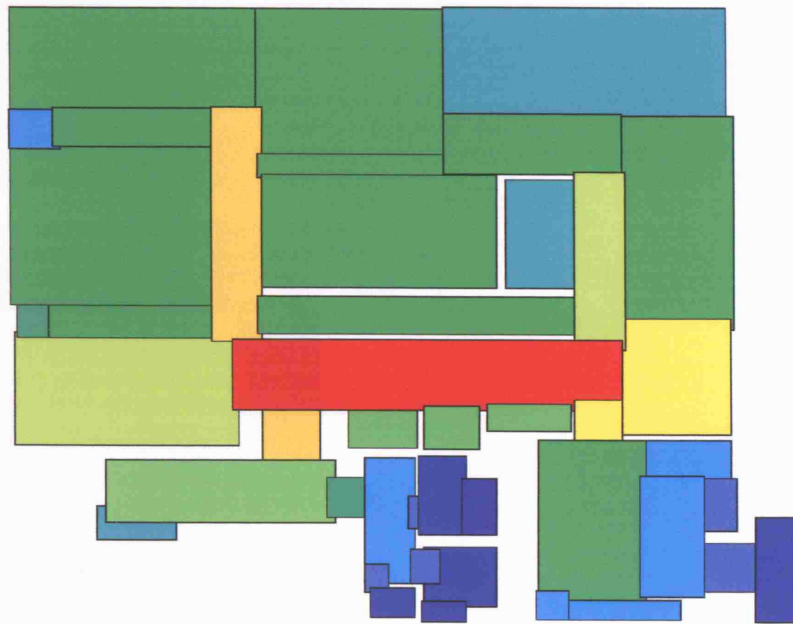
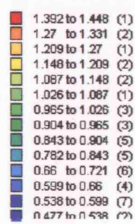
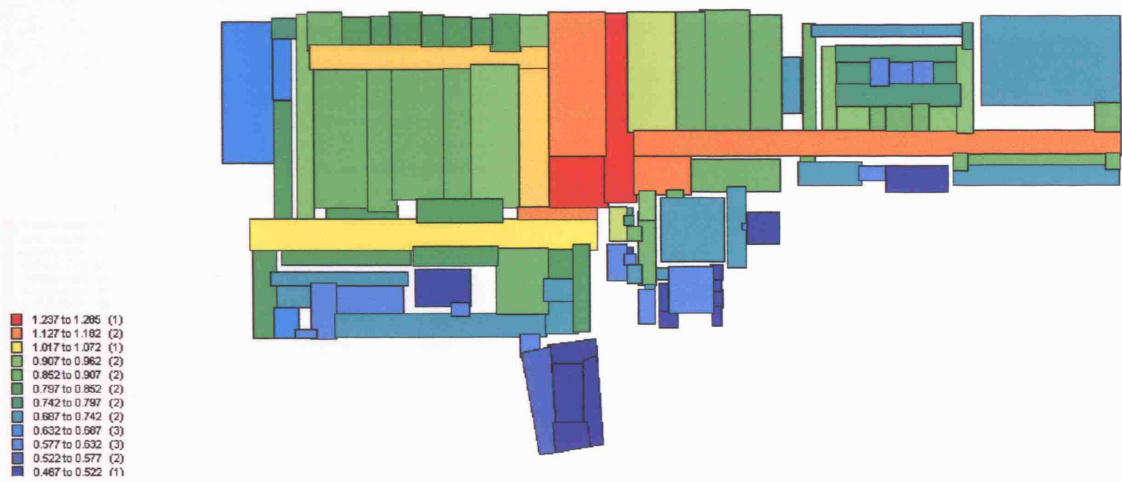


Figure 4.13 Price and Myers second floor convex maps with and without the office furniture



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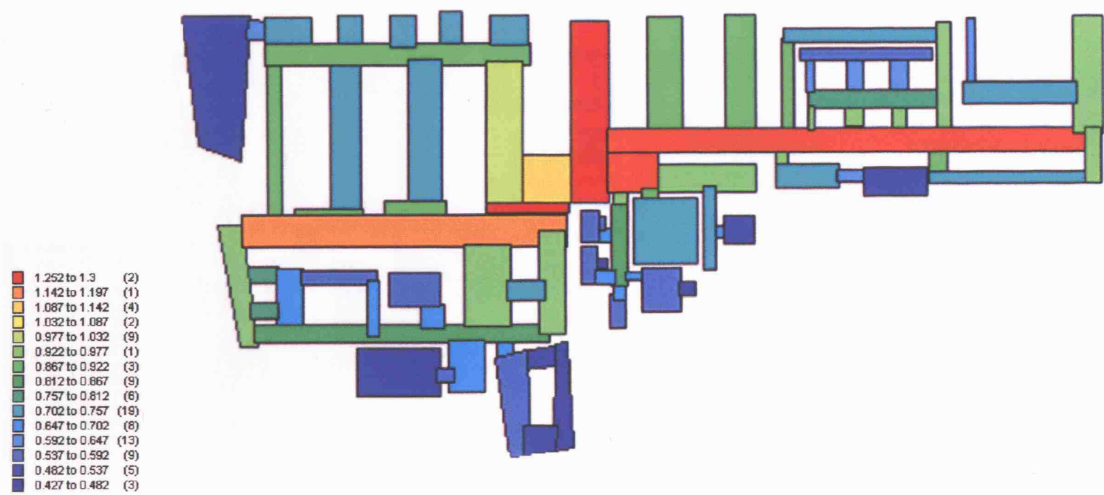
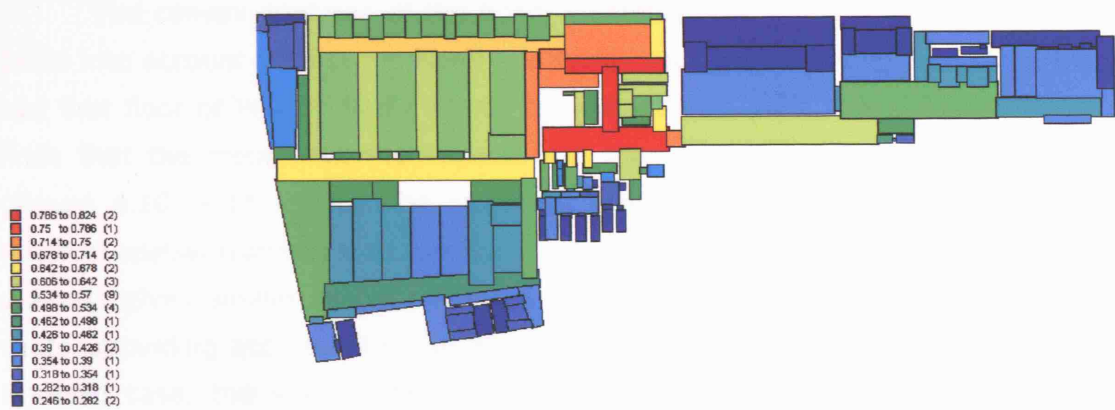


Figure 4.14 Buro Happold lower ground floor convex maps with and without the office furniture



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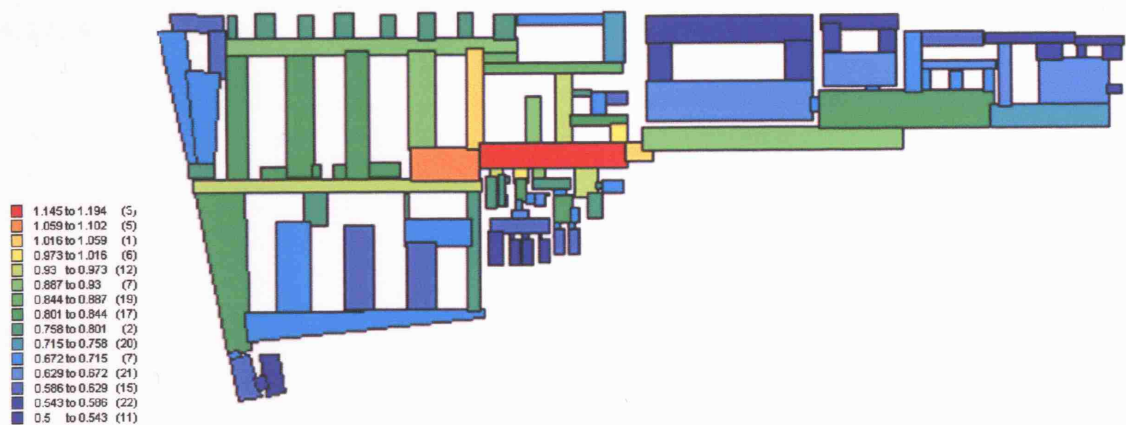
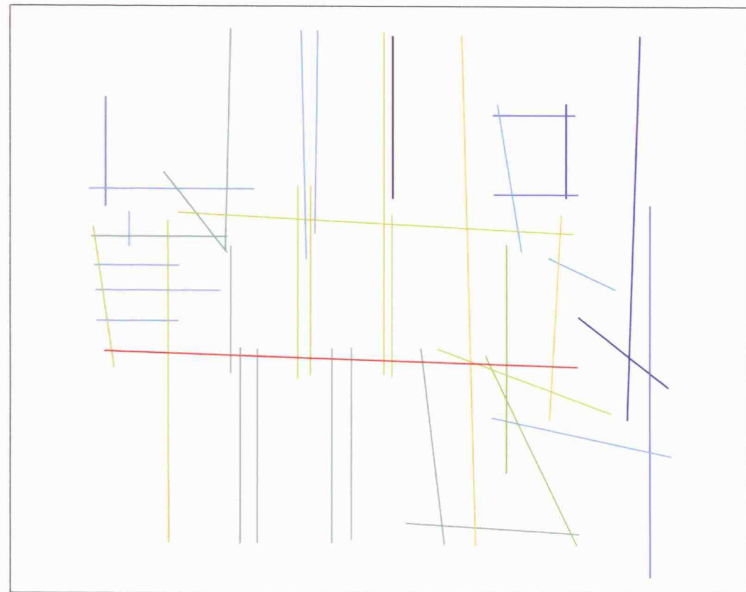
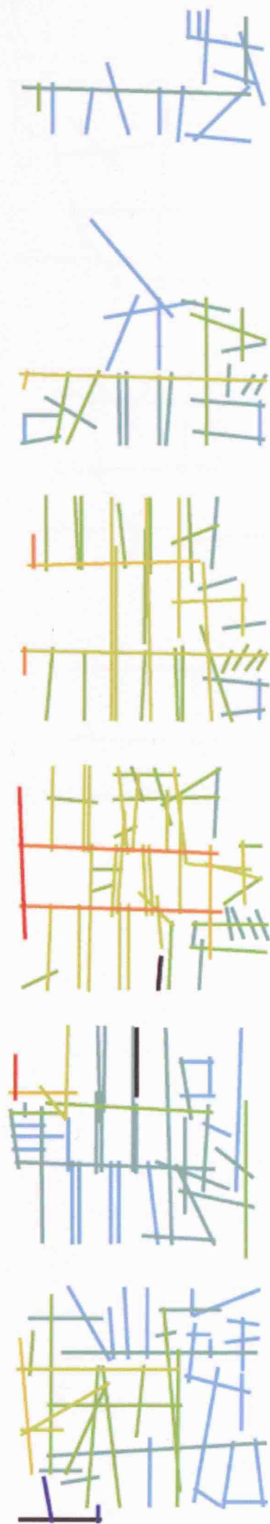


Figure 4.15 Buro Happold ground floor convex maps with and without the office furniture

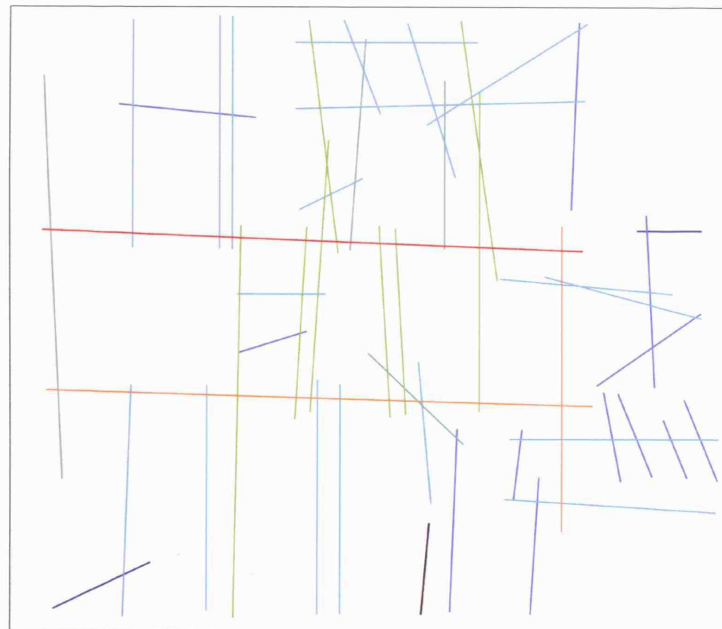
The convex analyses of the floors studied in the three office organisations, takes into account both unfurnished and furnished space. Starting with the ground and first floor of Whitby Bird's office, convex analysis, with and without furniture, finds that the most integrated spaces are the two main corridors of each floor (Figure 4.10, 4.11). It can be said that Whitby Bird spatial system keeps the physical spatial features with furniture. In the Price and Myers case, the convex analysis gives similar results. The system is integrated in the main movement route, providing accessibility with and without furniture (4.12, 4.13). In the Buro Happold case, the analysis highlights that integrated spaces vary with furniture placement; desk locations increase spatial integration values in the spaces that link work places with other facilities, like the coffee area and the facility core on the ground floor (Figure 4.14, 4.15). The placement of the group director's desk under the staircase of the first floor, as well as the spaces around it, become integrated convex spaces. It is concluded that furniture changes the physical-spatial system creating navigational and spatial control movements, especially through the work places.

4.2.2 Global System

This paragraph focuses on global systems; buildings as a whole. An important syntactical principle is the relationship between local and global; how the local fits into the global system. Global axial maps were therefore drawn for all floors, and were compared to axial integration of the floors studied (figure 4.16, 4.17, 4.18).



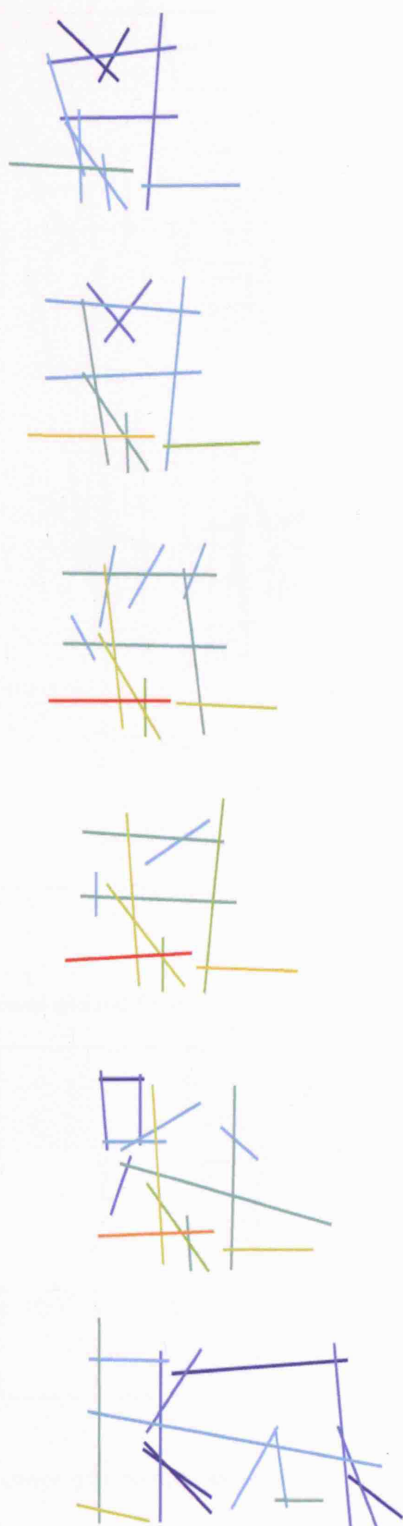
Ground floor axial map



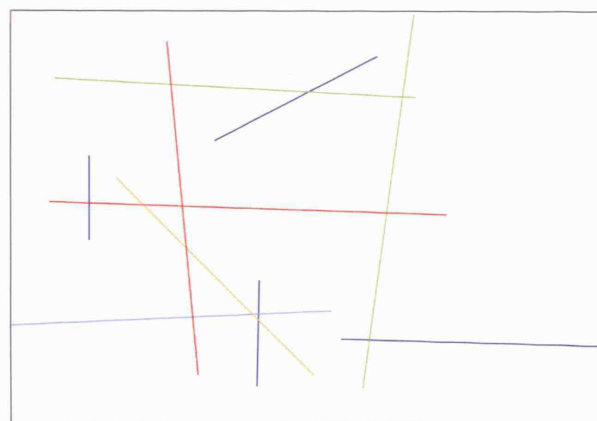
First floor axial map

Basement

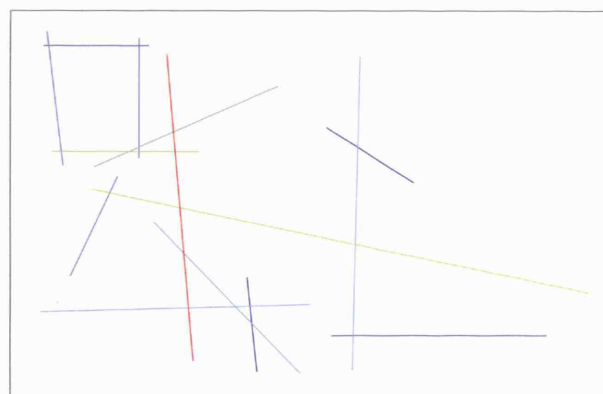
Figure 4.16 Whitby Bird linked axial map HH from fifth floor to basement in compare to first floor and ground floor axial maps HH-the forth floor is misses as it is not in companies occupation



Ground floor

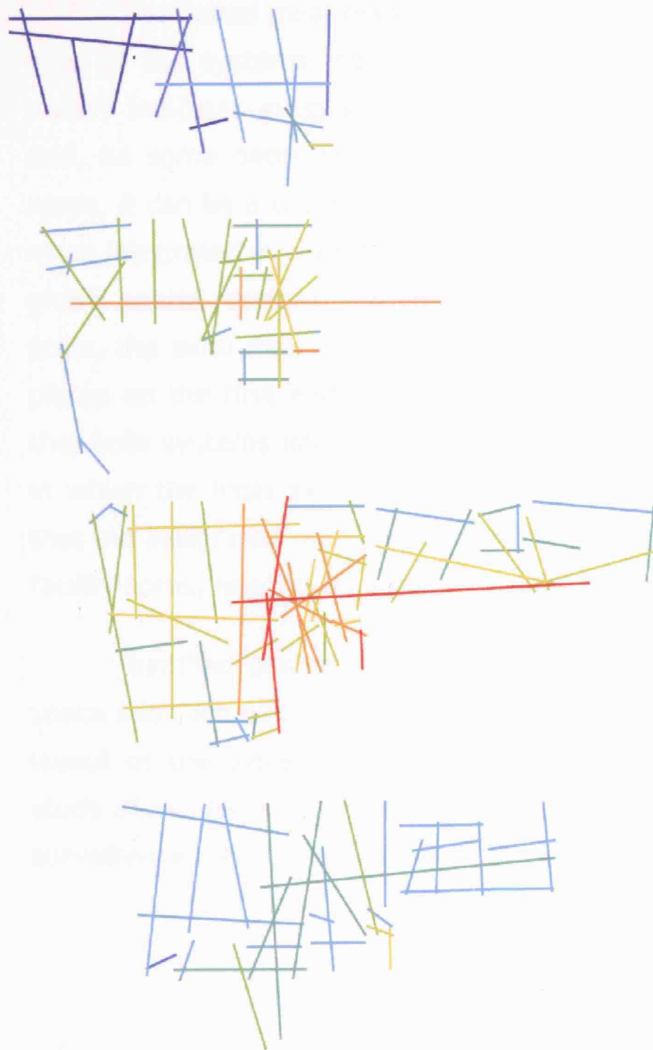


Second floor axial map



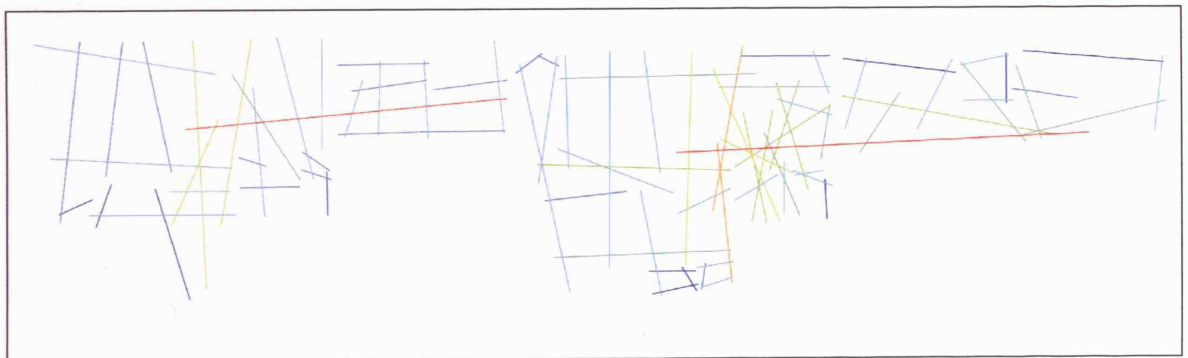
First floor axial map

Figure 4.17 Price and Myers linked axial HH map from fifth floor to ground in compare to first floor and second floor axial maps HH-the basement floor is misses as during the observational period it was refurbished



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Lower ground floor



Lower ground floor axial map

Ground floor axial map

Figure 4.18 Buro Happold linked axial map HH from second floor to lower ground in compare to lower ground floor and ground floor axial maps HH

The linked axial maps of the buildings indicate the most long and strait axial lines of the systems. For Whitby Bird the global axial map (HH) of the building mostly indicates integration on the basic movement routes, usually the corridors, and, on some paths through the work stations (first floor). Observing local axial maps, it can be argued that the lines that pass through the main floor corridors are more integrated in comparison to the global scale (Figure 4.16). In Price and Myer's global spatial system, the most integrated lines are the staircases. On a micro-scale, the axial map finds vertical and horizontal lines that pass through the work places on the first and second floors of the building (Figure 4.17). It is concluded that both systems integrate locally in comparison to Buro Happold's spatial system, in which the local axial maps highlight segregation. The local axial maps pick up that the integrated movements are these that pass through the coffee area and the facility cores, leaving workspaces' routes segregated (Figure 4.18).

Justified graphs were made on the buildings as a whole, to observe how space uses are distributed in the system. Focusing on the studied floors the spatial layout of the systems as well as deep and shallow spaces are established. The study allows for a discussion on natural movement and spatial control, and privacy surveillance with access, between the local and global systems (figure 4.19-4.28).

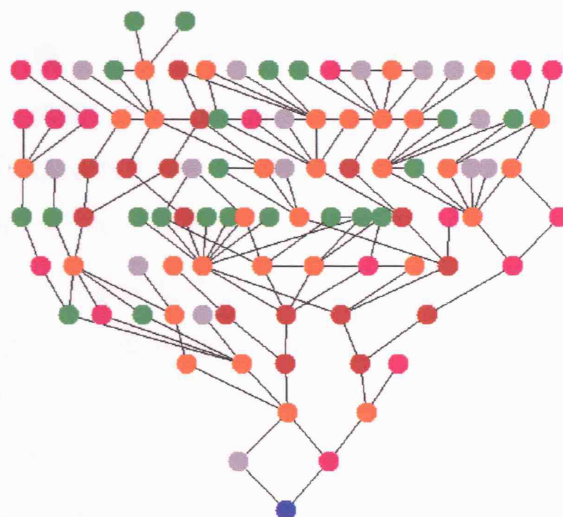


Figure 4.19 Justified graph of Whitby Bird building

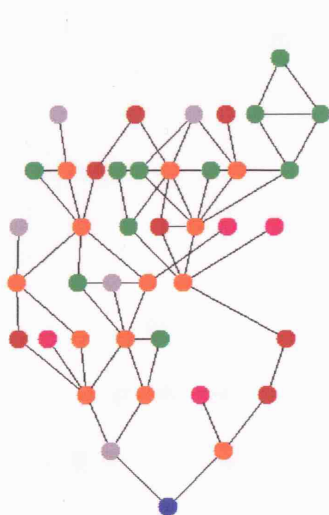


Figure 4.20 Justified graph from the main entrance to the first floor

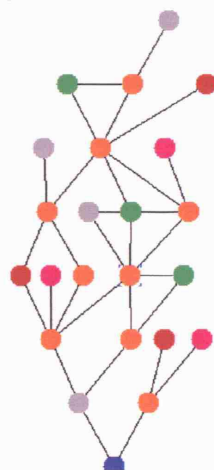


Figure 4.21 Ground floor Justified graph from the entrance

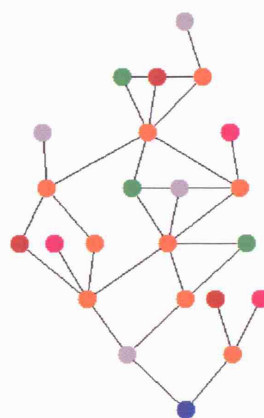
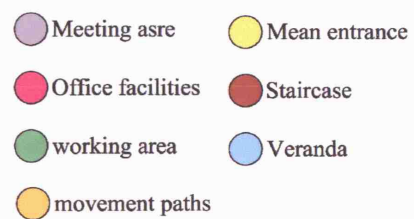


Figure 4.22 First floor Justified graph from the main staircase



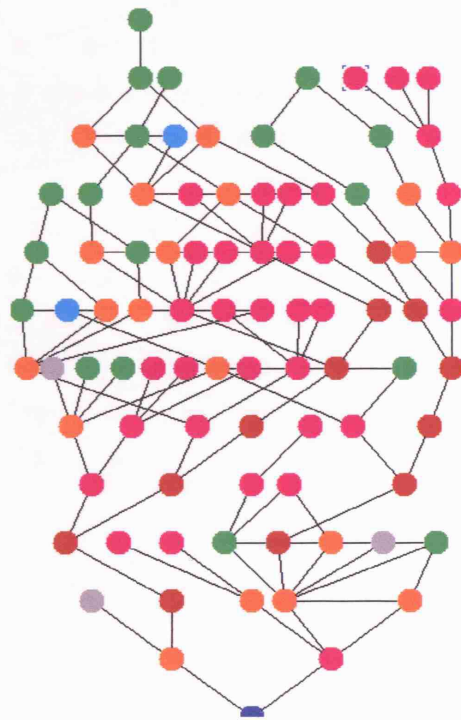


Figure 4.23 Justified graph of Price and Myers building

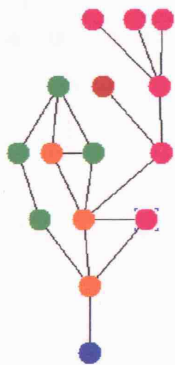


Figure 4.24 First floor Justified graph from the main staircase

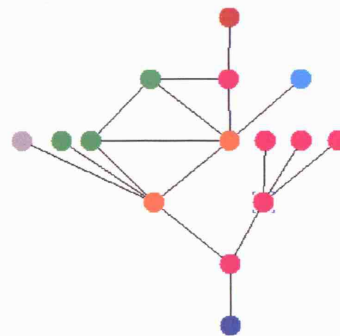


Figure 4.25 Second floor Justified graph from the main staircase

- | | |
|-------------------|---------------|
| Meeting asre | Mean entrance |
| Office facilities | Staircase |
| working area | Veranda |
| movement paths | |

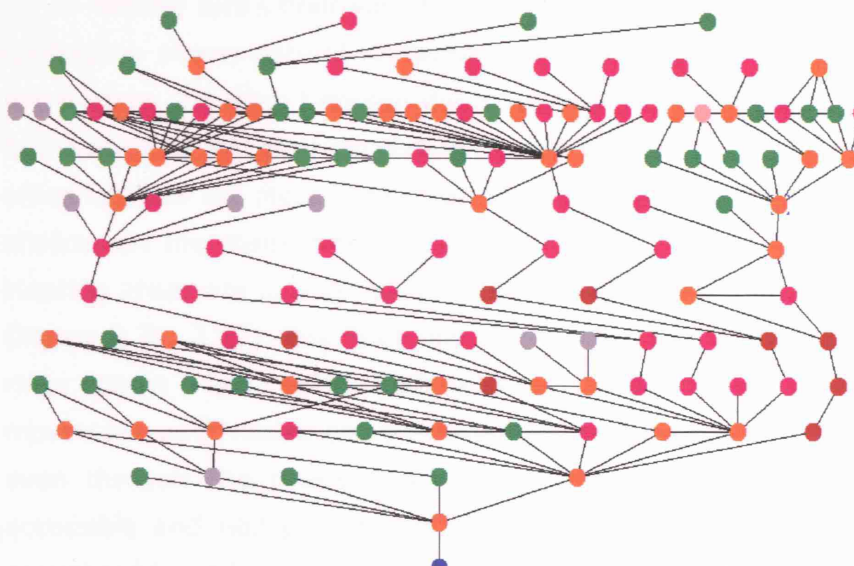


Figure 4.26 Justified graph of Buro Happold building

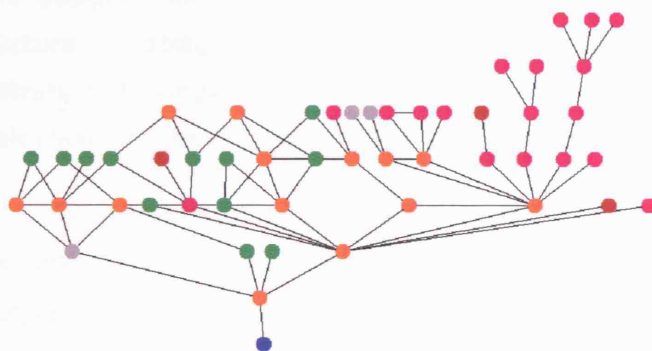


Figure 4.27 Lower ground Justified graph from the main staircase

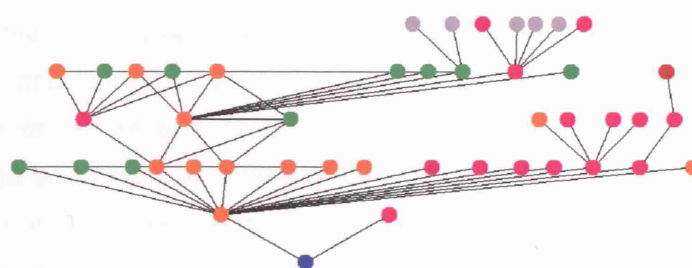
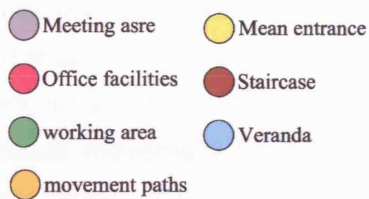


Figure 4.28 Ground floor Justified graph from the staircase that links the floor with the lower ground



Whitby Bird's floor layout is consisted of ring spaces (Figure 4.19). The ringy connection allows natural movement inside the space. In specific, looking at the micro scale, the rings between the movement nodes reinforce the open plan layout of the building and offer circulation (Figure 4.20-4.22). In general, work spaces and office facilities are placed to similar depths allowing spatial choice. Work spaces are shallow on the main movement routes, limiting spatial control and surveillance. Meeting areas are located all over the structure, creating public gathering spaces (Figure 2.21, 2.22). The Price and Myers office spatial system is also consisted of ringy spaces (Figure 4.23). Both in local and global systems, work places as well as movement path nodes are connected through rings, providing natural circulation even through the deeper work places and the facility cores. This creates an accessible and non-private spatial network (Figures 4.24-4.25). Buro Happold's spatial structure is a combination between 'bush' and ringy structure. The structure in general segregates the open plan grid pattern, providing limited spatial choice (Figure 4.26). In the micro scale it can be obtained that, meeting areas, which were designed as common areas (refer to chapter 3), are located deep into the structure, creating segregated public spaces (Figure 4.27, 4.28). The diagrams illustrate that ringy spaces are concentrated around the working spaces leaving weak choice to movements with other destinations.

On the syntactical analysis of the three office buildings on the global and the local scale, it is concluded that Whitby Bird's spatial system is characterised by the interplay between visible and integrated movements that pass through the work place creating spatial choice. Price and Myers building is well integrated with visibility and accessibility throughout the spatial structure. Both these case studies provide natural movements. According to justified graphs, both buildings provide accessible public spaces without spatial control and privacy. The difference between a 'long' and 'short' model is based on the number of rules that can be imposed on the movement of a body through the spatial configuration. It can be argued that the Price and Myers and Whitby Bird office buildings are short models because their spatial configurations maximise the random encounter of a body by space allowing real distance to be overcome. Buro Happold's spatial system is totally different. The most accessible and integrated movements are along the basic axes of the building's grid pattern but these movements suffer from visibility. Movement patterns can be identified as linear with external directions, as access through the work areas are limited. Building furniture creates navigational space patterns and reduces movement links between shallow and deep spaces, with spatial controlled work places. It can be argued the Buro Happold office building is a long model with ritual-like movements imposed by space.

4.3 The Social System

Seeing office organisations as collective social places, the task is to understand the fabric of encounters. The study is interested in sorting interaction within groups and between groups. On the relationship between the local and the global, this time from the social point of view, a key idea is that *'the degree organisation is divided into groups affect the interaction patterns within It'* (Hillier, et al. 1985). What therefore are the social features created for real and social distances? The observational findings are illustrated on Table 4.2.

| | Whitby Bird | Price and Myers | Buro Happold |
|------------------------------|-------------|-----------------|--------------|
| Real behaviour survey | | | |
| static snapshots | | | |
| IT | 50 | 34 | 44 |
| Sitting | 5 | 9 | 10 |
| standing | 12 | 12 | 32 |
| talking | 33 | 45 | 14 |
| movement traces | | | |
| internal movements | 35% | 45% | 22% |
| external movements | 18% | 5% | 48% |
| collaboration movements | 34% | 45% | 4% |
| facility movements | 13% | 5% | 26% |
| questionnaires | | | |
| Frequency _whole building | 55% | 68% | 17% |
| Usefulness _whole building | 49% | 61% | 7% |
| work with _whole building | 16% | 54% | 28% |
| Frequency _studied floors | 78% | 89% | 26% |
| Usefulness _studied floors | 72% | 74% | 11% |
| work with _studied floors | 46% | 89% | 35% |

4.3.1 Observation Techniques

Observation methods were applied to examine physical and social levels of spatial interaction on the six floors studied. The observational survey of patterns of space use, behaviour and movement was undertaken for all accessible areas on the floors studied, three periods per day, following the space break up of convex analysis. The investigation focuses on different levels of interaction within these floors. Static snapshots were divided in two different categories; individual and social activities (using computer, sitting, standing, talking, moving). The observations are repeated several times to obtain satisfactory statistical mean values (Appendix, Figure A.1-A.6). Except for the static snapshots the analysis provides movement traces to investigate movement patterns inside the work areas, and to distinguish external from internal, and collaboration from facility, movements.

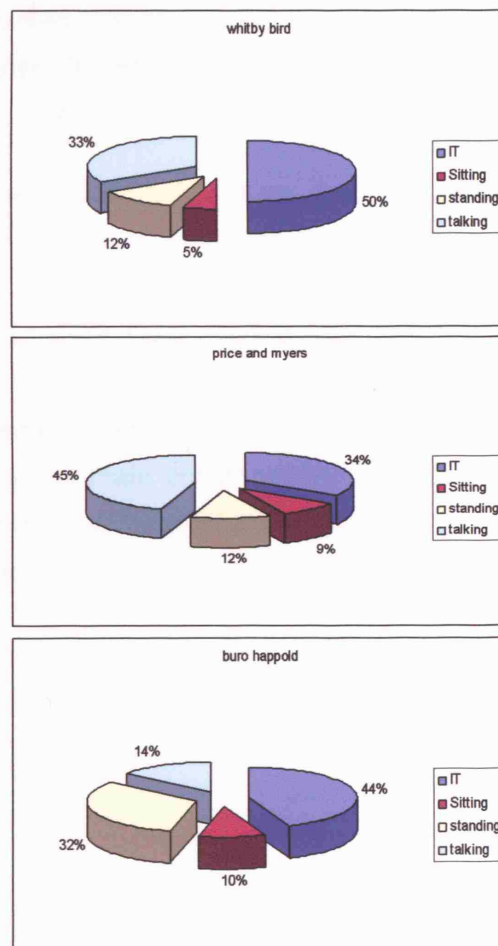


Figure 4.29 Spatial activities pies charts of the three offices

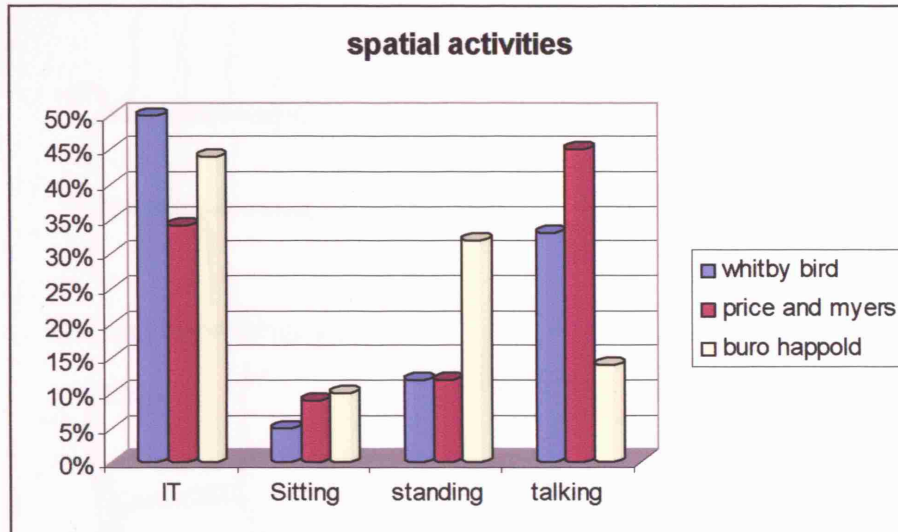
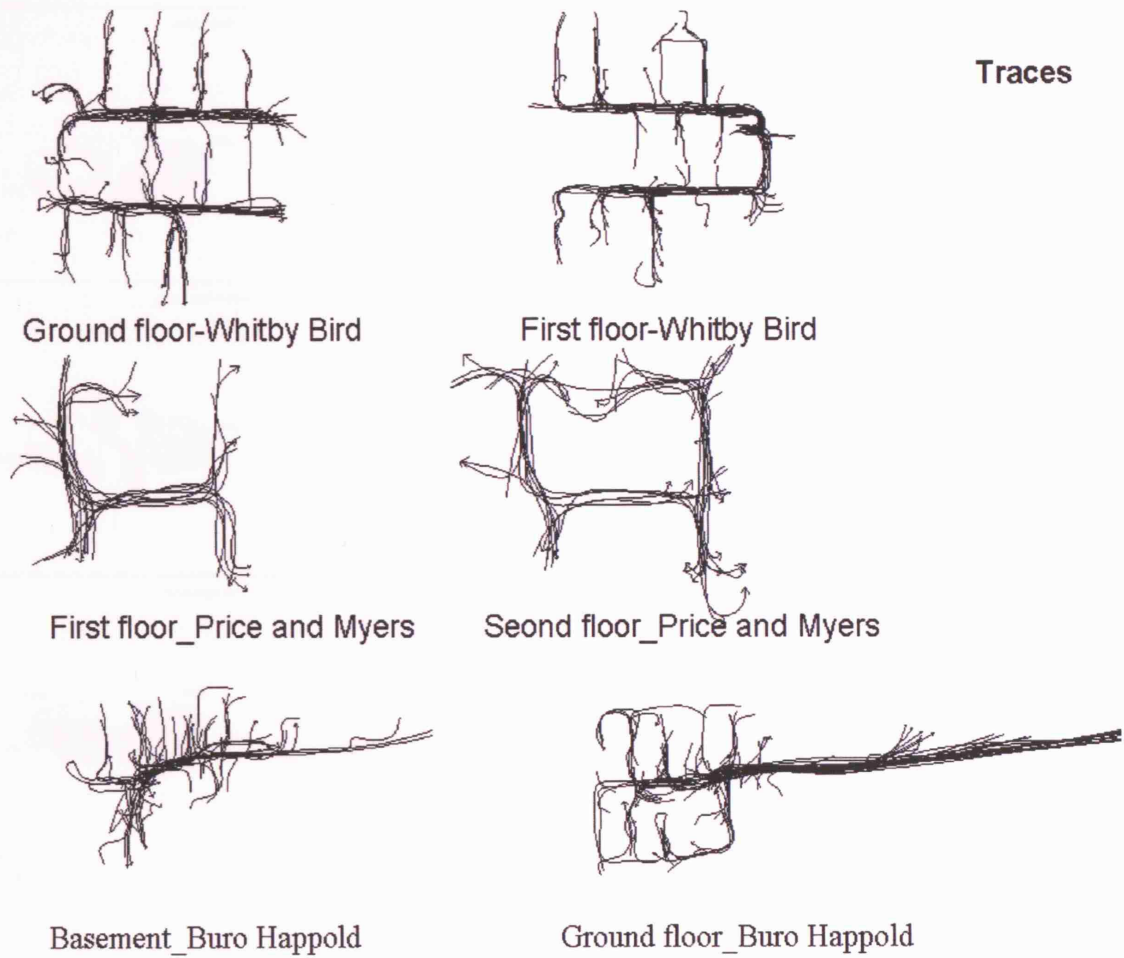


Figure 4.30 % spatial activity of the three office building

From the observed data (Figure 4.29, 4.30) it is concluded that the three offices studied use computers as the basic work tool. Social activities (talking) are concentrated in Whitby Bird and Price and Myers office buildings. Buro Happold concentrates on individual spatial activities (standing).

The movement traces were conducted with the sequence the static snapshots were mapping. The traces identify four types of movements (Appendix, Figure A.7-A.12). First internal and external movements were noted, and movements were then divided into collaboration and facility movements. Internal movements are movements that take place on the same floor. External movements are movements that have destination or starting points on other floors of the building or the main entrance. Facility movements are the movements to use work equipments, such as printers, while collaboration movements are movements in the main direction of other employees' seats to meet, discuss or work together (Figure 4.31).

Traces



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Figure 4. 31 Movement traces in the three office buildings

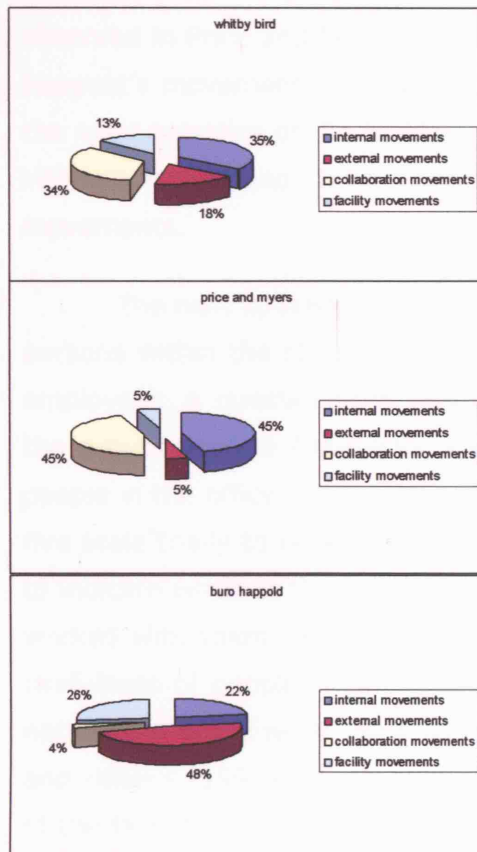


Figure 4.32 Movements pie charts in the three office buildings

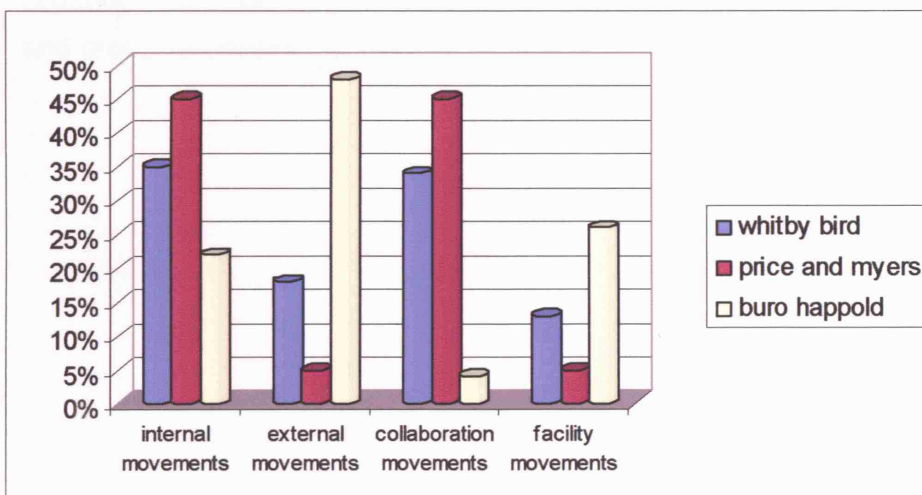


Figure 4.33 % movement types of the three office building

The data highlight that the most internal-collaboration movements were observed in Price and Myers and Whitby Bird work spaces (Figure 4.31-4.33). Buro Happold's movements are external with the main destinations the coffee area and the main entrance of the building. From the observed data, it was found that social interactions (talking) take place in spaces that provide for internal collaboration movements.

The next strategy is to investigate the social network by questionnaires to all persons within the studied organisation. To examine the contact network between employees, a questionnaire was created and distributed among the work staff of the groups studied (Appendix, Figure A.13). The questionnaire listed by name all people in the office organisation. Respondents were asked to tick a box on a one to five scale (daily to never) to indicate how frequently they saw each person named, to indicate whether they found the meeting useful for their work, and whether they worked with them regularly. The questionnaire, in the last column, asked for the usefulness of people, trying to decide the degree of usefulness for those who did not have a direct work relationship with the person concerned. This refers to Penn and Hillier's (1991) argument that the degree of knowledge dispersion is a product of the fact that people are useful because of other things. Taking into account the argument that work interactions are very much affected by the relationship between the local and the global; in what degree people that belong to different working groups are useful from others? The statistical analysis of the questionnaires, (120 in total), were conducted in two separate ways. Firstly counting responses on the whole office organization and then focusing only on floor and group responses.

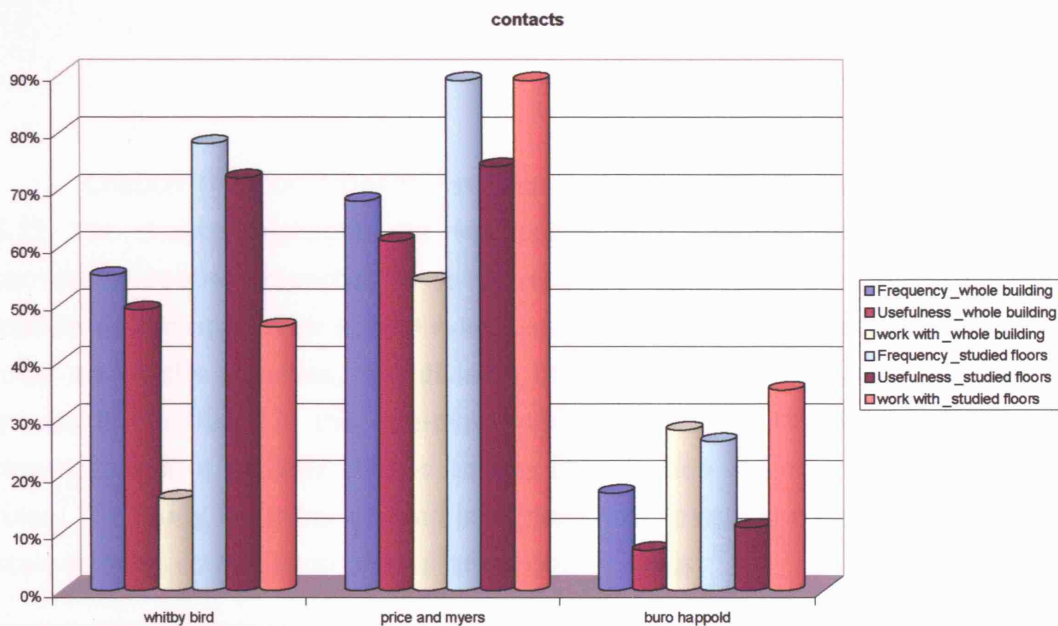


Figure 4.34 % questionnaires responses of the three office buildings

From the questionnaire data (Figure 4.34), people use, know and see more people from the same work group or floor area. For the office organisations as a whole, Price and Myers has the more frequent contact rates. In the same office people find a large proportion of their colleagues useful although they haven't always worked with them. The same seems to happen in Whitby Bird's social office network. The usefulness rate is much higher than the actual number of persons respondents have worked with. In the Buro Happold office the social network has less frequent and useful rates.

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Measuring only the responses from the floors and work groups studied, Price and Myers has the highest record for frequent contacts. In Whitby Bird people find others useful despite not having worked together. In Buro Happold's social system people work with others but do not find them useful.

Observing the organisation-accommodation relationship in the three office buildings, the data can be analysed to assess the degree to which the spatial and managerial structure of the office organisation can be held to have an effect on the way people move around the buildings during their everyday work, and whether there are any detectable effects on reported interactions and encounters within, and between, work units. The findings will define the division of labour within, and between, work units.

5.0 Findings

Introduction

Chapter five concludes the software and observation-related findings (Table 5.1). The chapter highlights the key points from the analysis, with the aim of correlating spatial properties to social records. Having analysed the configuration models according to their spatial rules (long/short model), and focusing on different roles and tasks activities, the division of labour within, and between, the work groups is clarified. On the interplay between physical and social networks, it is shown that it is directly related to the organization management decisions and rules. The study is further divided into three main parts; the local scale, the global scale and the combination of local and global findings.

| | Whitby Bird | Price and Myers | Buro Happold |
|--|---------------------------------------|---------------------------------------|---|
| Spatial properties +social activities | | | |
| occupancy rates | 0.62 ground floor 0.61 first floor | 1.15 first floor 0.9 second floor | 0.7 lower ground floor 0.76 ground floor |
| visiting ratio | 5.75 ground floor 5.5 first floor | 5.76 first floor 2.03 second floor | 8.7 lower ground floor 13.5 ground floor |
| synergy effect | 0.43 | 0.99 | 0.93 |
| relations within the same group | 65.3 | 84 | |
| relations between different groups | 40 | 61 | |

5.1 Spatial Properties and Movements

This section shows that space is a strong predictor of movements and interactions, arguing that the spatial system creates the foundation for social contacts and interactions.

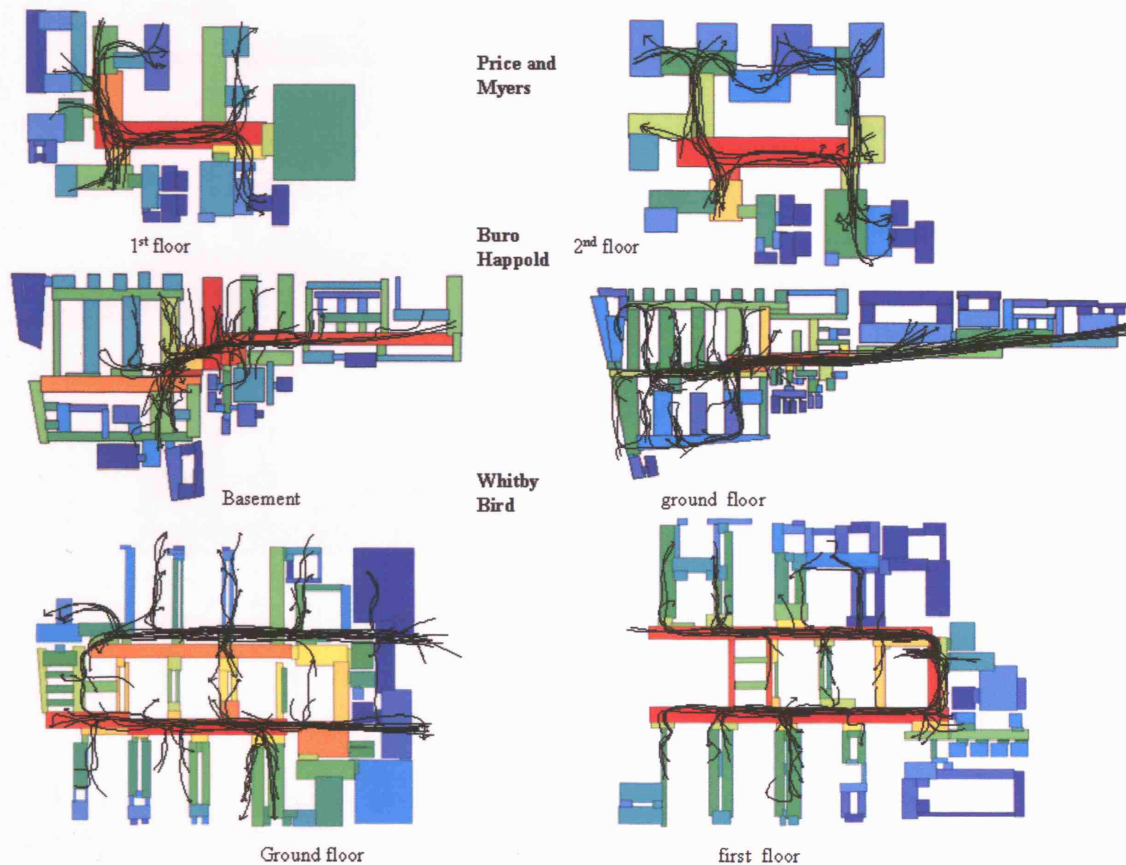


Figure 5.1 Convex maps without furniture in relation to movement traces

Convex spaces break up in relation to real movement patterns, demonstrate that movement patterns are based on integrated convex spaces (Figure 5.1). In the Buro Happold case, the long model of its spatial configuration minimises natural movements in the most integrated spaces, leaving the left side of the lower ground floor detached.

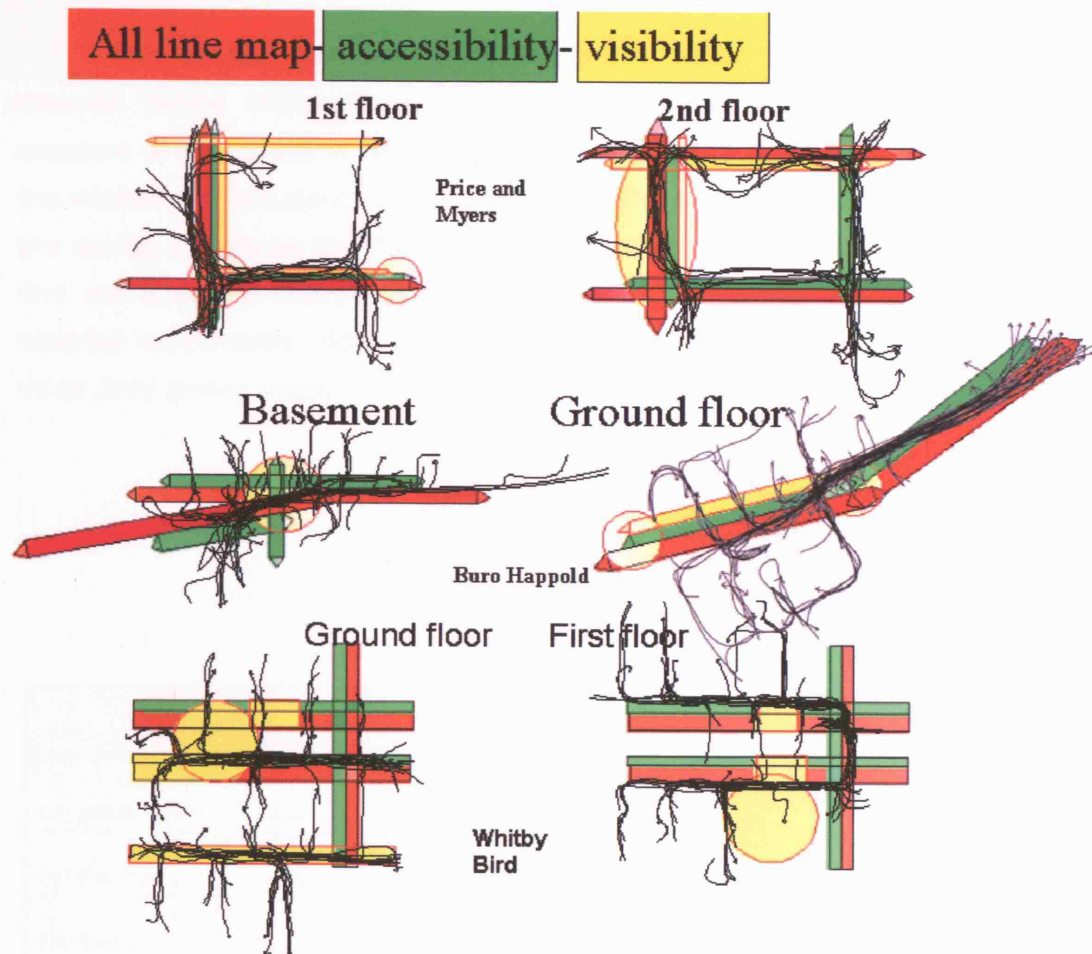


Figure 5.2 Diagram illustrating all line map, visibility and accessibility axes of the studied floors in compare to movement traces

Decoding the spatial identity of each work area and correlating these with the real movement patterns observed underlines how visible and accessible people's movements are (Figure 5.2). The diagram indicates that spatial properties are associated with people's movements on the local space (floors). Specifically the diagram illustrates in the Price and Myers and Whitby Bird situations that movements take place where accessibility and visibility features are highly integrated. The red axes indicate on the all line map integrated movements inside the spatial system. Movement patterns, observed through movement traces, are very much the same in total with all line map results in the two buildings, determining the short model's ability to allow natural movements in the spatial system (linear and segmental movements). An interesting point is that in the case of Buro Happold the movements do not follow all the actual integrated routes, and they use less visible and less accessible routes. The diagram predicts the long model's spatial rules that minimise natural movements. As such, to what degree do long or short models affect spatial interactions in the work environment?

5.2 Socio-spatial Interactions

This section decodes social encounters within groups, for spatial models mapped during observations. As the floors studied vary in size, an important measure of space use in relation to space size is the occupancy ratio which shows the intensity of occupancy of the work area. The occupancy ratios take into account the sitting people on the floors studied and can be compared to the visit ratio to find out how the occupancy conditions inside the workplace affect internal and external movements. Both occupancy and visit ratios are according to snapshots three daily period maps.

| | occupancy |
|-----------------|-----------|
| WB ground floor | 0.82 |
| WB first floor | 0.81 |
| PM first floor | 1.15 |
| PM second floor | 0.9 |
| BH basement | 0.7 |
| BH ground floor | 0.78 |

| WB | occupancy | arrive+leave | ratio=arrive+leave/occupancy |
|--------------|-----------|--------------|------------------------------|
| Ground floor | 42 | 7.3 | 5.75 |
| First floor | 44 | 8 | 5.5 |
| | | | |
| PM | occupancy | arrive+leave | ratio=arrive+leave/occupancy |
| First floor | 17.3 | 3 | 5.76 |
| Second floor | 18.3 | 9 | 2.03 |
| | | | |
| BH | occupancy | arrive+leave | ratio=arrive+leave/occupancy |
| Basement | 31.6 | 3.6 | 8.7 |
| Ground floor | 35.3 | 2.6 | 13.5 |

Tables 5.2-5.3 Visiting and occupancy ratios of the studied floors

Tables 5.2, 5.3 demonstrate that Price and Myers work places have the highest occupancy rates, while the same spaces have the minimum visiting rates. The same pattern is repeated in the other two case studies. Whitby Bird's occupancy ratio is higher than Buro Happold but the visiting rate is lower in comparison to Buro Happold's value. The results confirm that in places with a high occupancy, visiting movements are limited. That is reinforced by remembering that Price and Myers and Whitby Bird movement traces highlight that both are integrated internally in the spatial system. Buro Happold's spatial system provides for external movements. From the three case studies, short spatial models with high occupancy spaces are integrated locally, thus reducing visiting movements.

To investigate how different integrated systems affect social interactions within work units, it is necessary to first illustrate sitting/standing charts between employees to distinguish social from individual activities (Figure 5.3).

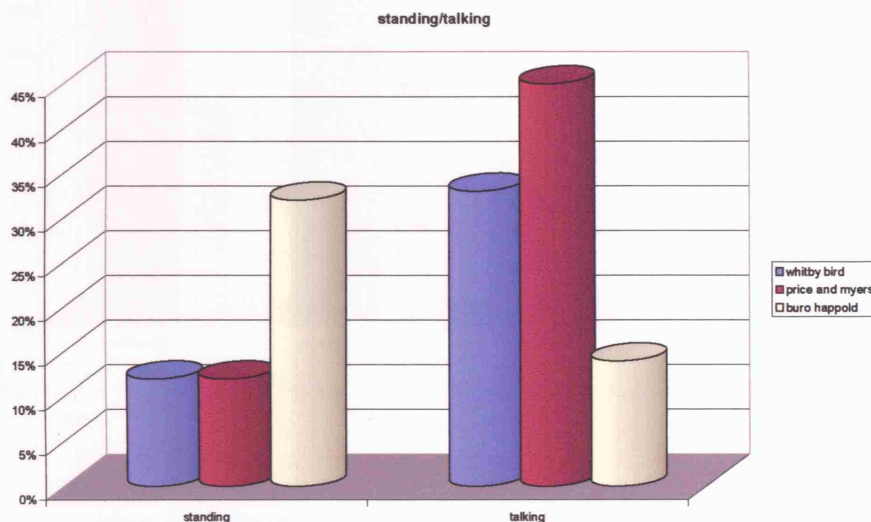


Figure 5.3 sitting standing ratios according to static snapshot observations

From the above diagram it is observed that high local occupancy groups like Price and Myers and Whitby Bird provide for talking rather than standing activities. Buro Happold spatial behaviour is consistent with standing activities. It is argued that Price and Myers and Whitby Bird spatial activities are social, since they engage more than one person (talking cycles, refer to appendix) in comparison to Buro Happold spatial activities that are mostly individual.

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Penn, Desyllas and Vaughn, 1999, argued that socially segregated people within the work environment move more in comparison to integrated social systems. This can be explained by taking into account two parameters: firstly, the spatial system for the IBG1 group has weak accessibility and visibility features, providing individual rather than social spatial activities with the need to visit other places, and secondly, looking at the management model of the IBG1 group it is noted that the group is sub-divided into smaller temporary groups, creating segregation on their transpatial network. Price and Myers' as well as Whitby Bird's work groups are related spatially, and transpatially within them, as groups are permanently located at the same desks and socially in the same work unit. Their spatial systems reinforce social interactions due to integrated visibility and accessibility properties. Summing up, spatial and transpatial relationships within work groups are shaped through their spatial models and by managerial rules and decisions that bind together and create strong localised work units (Figure 5.4).

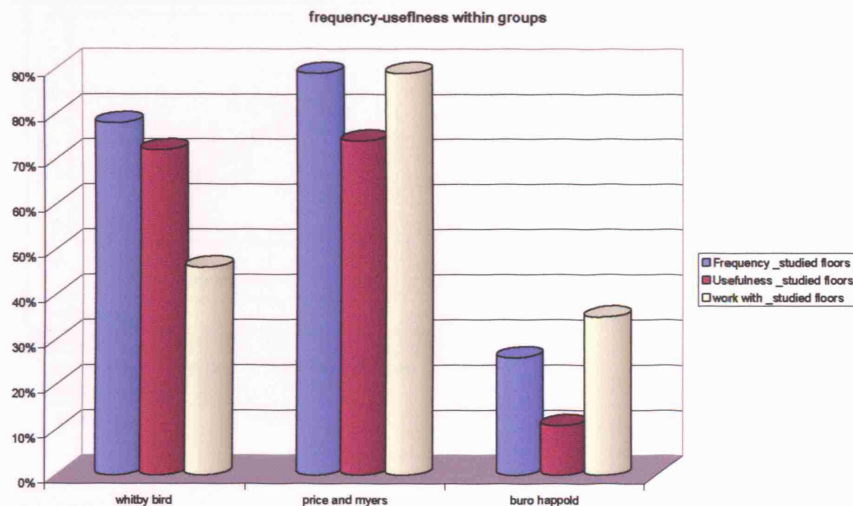


Figure 5.4 frequency and usefulness rates within the studied working groups, according to questionnaires responses

How do different degree of spatiality and transpatiality affect contacts within work units? From the questionnaire results, there is a correspondence between spatial proximity and social encounters on the micro-scale. Thus, within the same work groups, Price and Myers has the most frequent and useful contact rates. The same seems to happen in Whitby Bird's social network. Buro Happold's IBG1's social network has the highest rate of anonymous relationships, since the frequency and usefulness rates are low. It is therefore concluded that spatial and transpatial related groups reinforce frequent and useful contacts within them.

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5.3 From Micro-scale to Global Scale

From the local to the global sector, there is a significant positive correlation between building's spatial accessibility and mean frequency of encounters cited by other business units. This means the more accessible the building, the greater the number of people directly reachable from other work units. The spatial structure of the building can integrate or segregate people from other people, controlling their accessibility by spatial differentiation (Steen, Blombergsson and Wiklander, 2001).

To confirm the argument, correlations between local and global integration were conducted in every office building to observe how the local property fits into the building's global system and indicates global spatial accessibility (Figure 5.5, 5.6, 5.7). The results highlight the synergy values of the three case buildings studied.

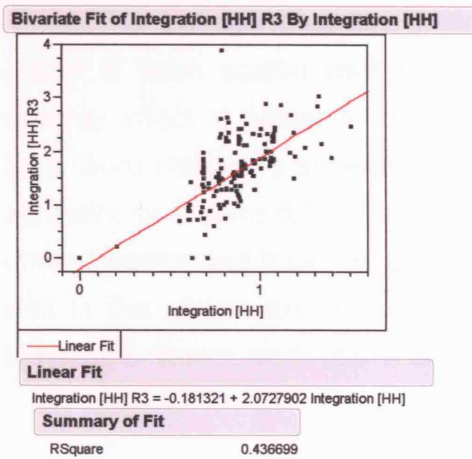
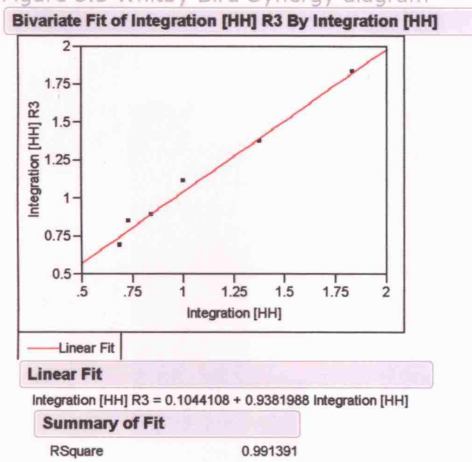


Figure 5.5 Whitby Bird Synergy diagram



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Figure 5.6 Price and Myers Synergy diagram

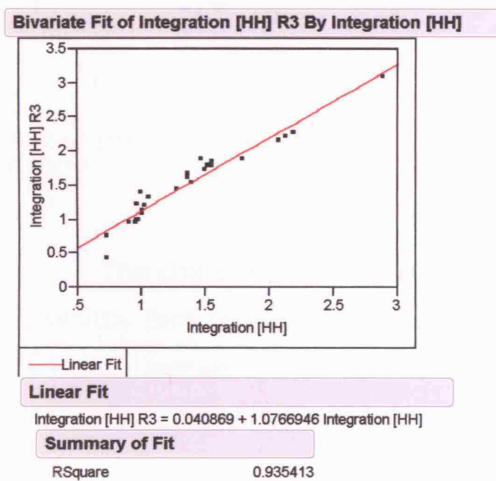


Figure 5.7 Buro Happold Synergy diagram

The synergy diagrams indicate the relationship between the local and the global of each spatial configuration. The results indicate that Price and Myers' synergy effect is higher in comparison with the other two office buildings (Figure 5.6). Buro Happold's synergy effect is 0.93 indicating strong potentials on spatial accessibility (Figure 5.7). Whitby Bird's synergy value is lower in comparison to the other systems and it can be argued that the local system of the building does not fit well in the global structure (Figure 5.5). The question arises as to how contacts between different work teams are related to global spatial accessibility?

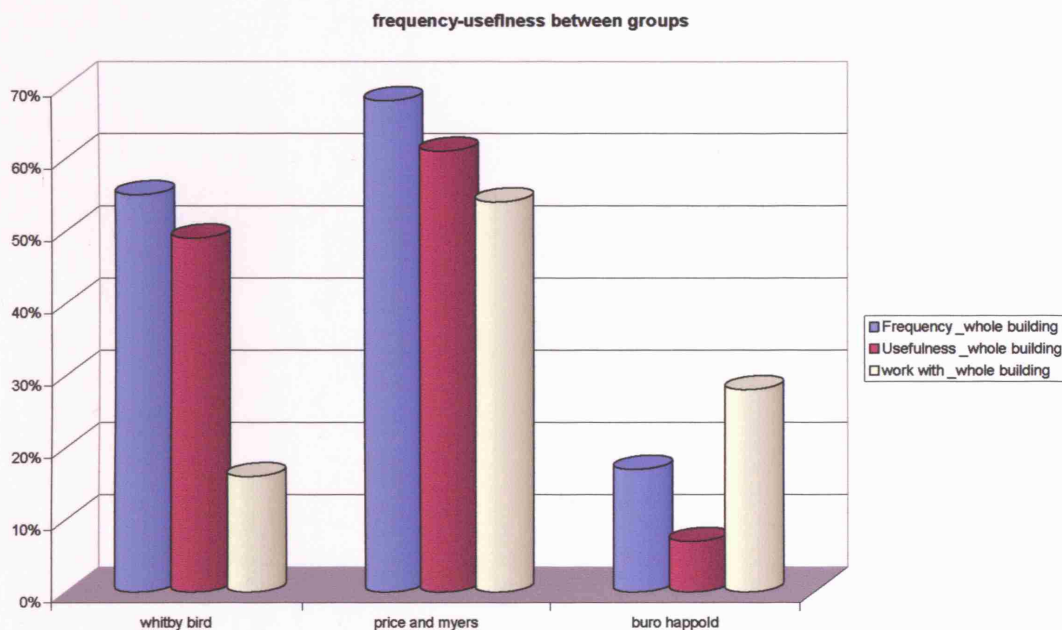


Figure 5.8 Frequency and usefulness rates between working groups according to questionnaires responses

The charts illustrate that except for frequent contacts at Price and Myers and at Whitby Bird cooperation is useful although work experience is weak (Figure 5.8). As Penn, Desillas and Vaughn (1999) argue, people that have been found useful by their colleagues, but have not collaborated with them are useful for 'other' reasons.

Synergy results and observational data create a contradictory relationship between each other. In detail, Price and Myers' global system allow global accessible movements through the building as a whole, resulting in frequent and useful work contacts among different work teams. In Buro Happold synergy value creates an accessible global spatial system, but infrequent and less useful social contacts were observed. In Whitby Bird, although with a low synergy record, the building socially integrates in the global system. This is of interest as Hillier and

Netto (2001) argue that segregated spatial systems associated with vigorous and active social encounters, are the most integrated places, because people override spatial difficulties so as to interact, and knowledge is effectively transmitted.

Remembering that spatial patterning varies with socio-cultural and micro-economic rules which tend to affect co-operation, this issue drives the consequence that the way employees relate in space is also affected by a company's organizational management rules. As the Whitby Bird management model reinforces transpatial relations between different working units, allowing different work jurisdictions to take active part on the organisation's decisions; relating them under the concept of the firm as a whole. Thus, global spatial isolation is overridden and the office society is integrated as a whole. Buro Happold's global spatial accessibility is minimised as work units are independent business groups, creating autonomous relations dismissing the shared idea that belong under the same organisation.

Global spatial and transpatial links are reinforced through spatial and managerial properties, and reinforce frequent and useful contacts between different work units.

5.4 Relationships within, and between, Work Groups

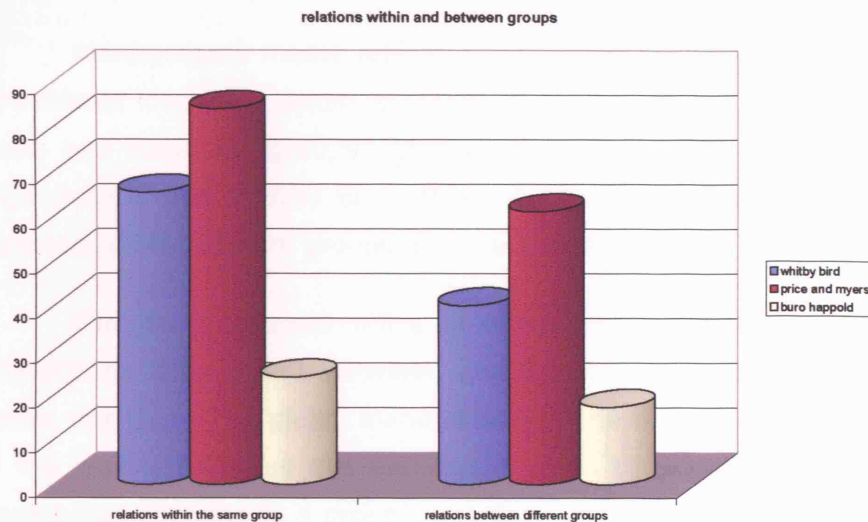


Figure 5.9 Relations within and between working groups

Summing up, the relationships within, and between, different work units is illustrated in figure 5.9. The aim is to compare the three case studies, observe the organization-accommodations relationships of their offices, and classify the division of labour within and between them.

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The chart reveals that Whitby Bird and Price and Myers office organizations create strong relationships between, and within, groups. The rates in the Price and Myers case are higher, because, firstly, the short model building allows natural movements throughout the building. Spatial interactions and encounters within, and between, different work groups can therefore be reinforced through spatial choice and wide visual fields, independent of real distance (synergy effect). Secondly, the organizational management consists of different status employees and partners that make decisions for their local office organization in London. Providing permanent work groups creates strong spatial and transpatial relationships within, and between, them.

Whitby Bird creates strong relationships within, and between, different groups, because the organizational management provides office's local aims. Work spaces consist of different permanent groups. In this way the management model provides spatial groups with strong transpatiality within, since people related through the concept are work in close proximity but also through belonging to the same scientific field of knowledge. Remembering that the building is classified as a short model, maximising natural movements, spatial and transpatial accessibility

are bound together on the floors studied. In the global system groups are weakly related spatially due to low synergy value, but active transpatially, as the

management model reinforces collaboration between different groups with operational decisions taken at team level. Employees independently from their tasks and roles are grouped through the shared idea that belong to the same organisation. The Whitby Bird office organization creates encounters within, and between, different work groups, thus surpassing real and social distance.

The Buro Happold office building creates weak encounters and spatial interactions within, and between, groups. Organizational management plays an active role here. The global management of the company require rigorous changes in the way sub-groups are distributed so as to accelerate project development. Continuous changes to a group's structure and peoples' seating create anonymous and autonomous relationships. The long model of the building, allows few natural movements. It is argued that Buro Happold's work groups have weak spatial and transpatial links. Studying the global configuration of the building, groups are related spatially due to the synergy effect. Managerial rules create inert transpatial relationships between work groups, as they provide for independently integrated business group (IBGs) structures, dismissing the notion of collaboration between different work groups.

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It is concluded that Price and Myers and Whitby Bird group structures, due to their spatial and transpatiality credits operate like a mechanical solidarity as all group-members belong to the same team, have common and shared social experiences, and special sub-divisions within their work group are weak. Seeing the Price and Myers and Whitby Bird office buildings as a sum of work groups it is argued that office solidarity is organic, as each work group is a different organ which has specific roles and tasks inside the organization. Buro Happold work groups, due to weak spatial and social relations within the members, can be characterised under organic solidarity as the work groups are formed from a system of different organs-members, each of which has a specific role and task depending on a project's needs. In the Buro Happold office organization, the office society, which is the sum of the work groups, operates as an organic solidarity as each work group operates like a separate organ in the office organization; independent integrated business groups.

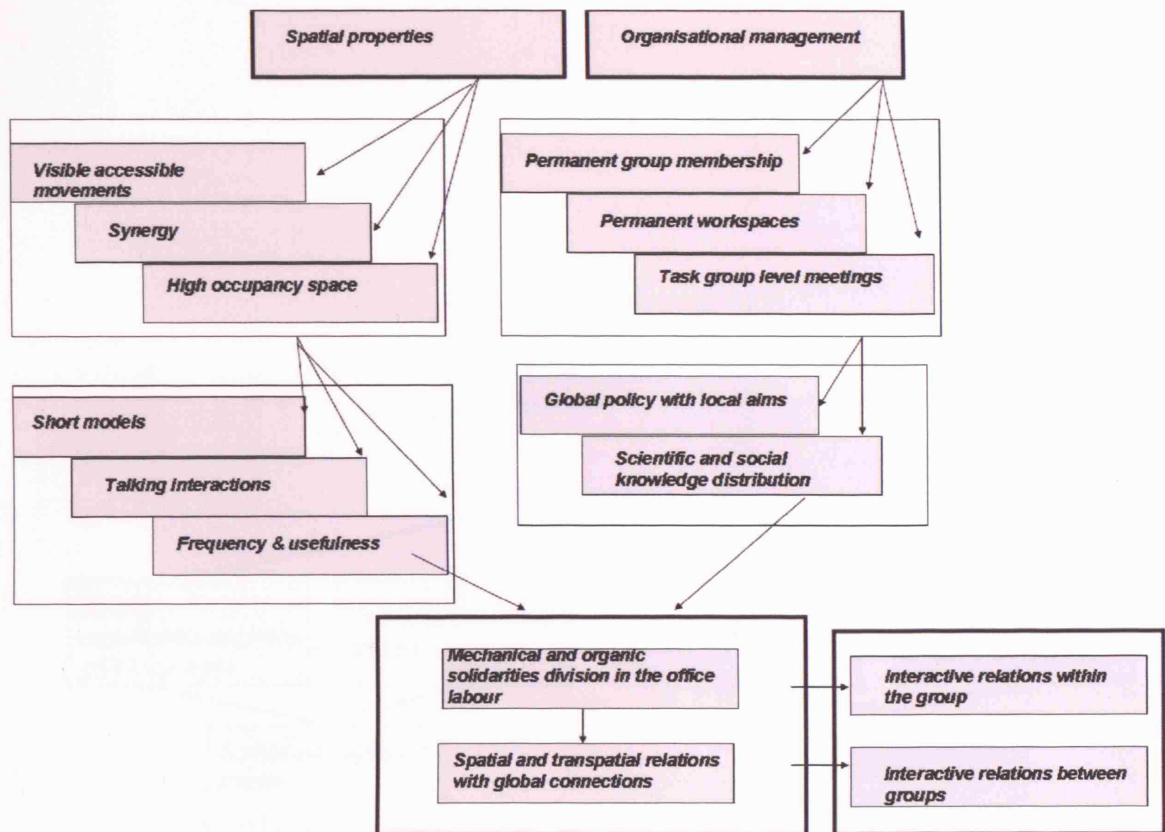
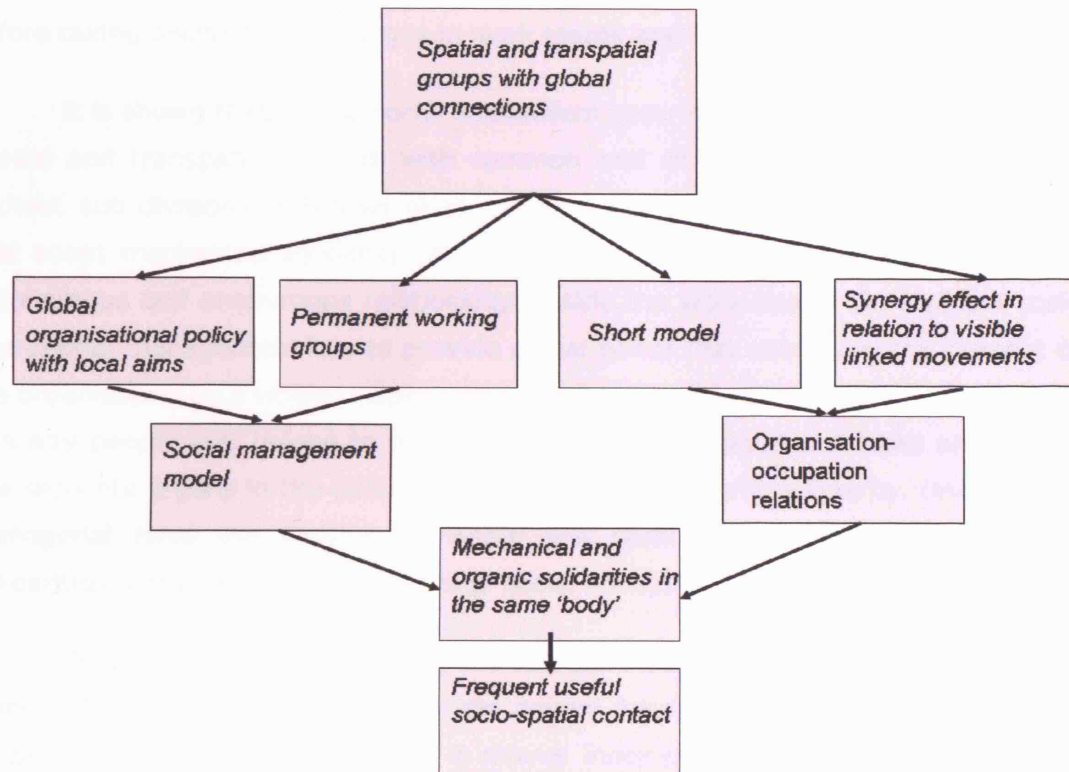


Figure 5.10 Thesis findings

6.0 Conclusions



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Figure 6.1 summary of spatial and managerial features, that were observed, regarding interactive relations within and between working groups.

The thesis investigates the role of spatial office systems and organisational management as drivers to create socially active work places, focussing on relationships within the same work group, and between different work units delivering social and scientific knowledge. The study concentrates on three office buildings in London and studies 13 work teams in total. All three case studies are similar office organisations – engineering consultants – but their spatial systems as well their management models are different. The aim was thus to explore the spatial and managerial components of employees' spatial behaviours and social contacts. The study sees office organisations as societies, office buildings as spatial configurations and organisational management as social and cultural rules embedded in space.

It is observed that there are two variables that affect life inside the office organisation. Firstly spatial models are good predictors of movements and spatial behaviours inside the system. The link between global and local spatial systems is

of great interest as it reinforces frequent contacts between different work groups. Integrated visual local systems provide natural movements and override spatial distance inside the system, creating short models. Secondly organisational management also plays an active role in social contacts. Efficient organizational management has to take into account the organisation-accommodation relationship before taking decisions on changes in work teams and employees' placement.

It is shown that strong social encounters occur in permanent groups that are spatial and transpatial related, with common and shared social experiences, and without sub-divisions. Effective relationships between employees occur in groups that adapt mechanical solidarity characteristics. Continuous changes can result in autonomous and anonymous relationships inside the work space. On a global scale operational management has to provide global policy that reinforces the concept of the organisation as a whole, inspired through the local identity of each work unit. In this way people that belong to different groups, roles, status and tasks are related like separate organs in the same 'body', creating an organic solidarity. Under these managerial rules the division of labour will reinforce mechanical and organic solidarities in the same society creating 'social harmony'.

'In one case as in the other, the structure derives from the division of labor and its solidarity. Each part of the animal, having become an organ, has its proper sphere of action where it moves independently without imposing itself upon others. But, from another point of view, they depend more on one another than in a colony, since they cannot separate without perishing' (Durkheim, 1984, p.192).

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The paper does not suggest an organisational working model as a manner for business success and productivity. The thesis analysed three office buildings during summer period. The limitations regarding time's duration and studied cases amount provide the need for further expansion in order to propose working models.

Future work can be focused on offices' micro-scale in order to relate employees' encounters with the nature of the work that they are being involved to (design, calculations, etc.). Another idea is to focus on organisation's original offices like Bath's Buro Happold office building in order to obtain the primary work's features. Organisations' privacy was a barrier in the study, since a lot of statements and documents that would be given a clear view about management were not available for the public. As well photographic material of the offices' interior was not permitted.

Never the less regarding the case studies, it can be concluded that work groups are strong spatial groups shaped through social or scientific ideas. Spatial and transpatial relationships occur within, and between, different work team, creating solidarities. The aim is to balance spatial and transpatial relationships for work groups recovering real and social distance and on the other hand controlling proximity. In this way they become local units with global relationships in the social and spatial fields. This thesis argues that this is the way to distribute knowledge, and for work places to become places for social action.

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Accessibility analysis- Provides a means of examining how integration is distributed within a system according to how accessible spaces are from different points in the configuration.

All line map- Is the map that represents all the lines that pass through the open space of a system. This gives bands of lines rather than a single axial line. It shows a large dimensional extend of the axial system than the least set. It picks up all the potential for movements not only linear along a space but also the segmental opportunities for movements.

Axial map- Is the map which consists of the fewest and longest strait lines of sight and access, which covers a spatial system and passes through every convex space. The axial map after the process is coloured according to the integration value of each line. The colour scale slides from red that is establishing the most integrated line to blue that is establishing the most segregated line.

Convex analysis- Is a two dimensional space syntax description. Identifies the fewest and fattest spaces that cover the system, by applying a rule which says the fat spaces always prevail over thin spaces. After possessing the map the convex spaces colours in the same manner as the axial map.

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Integration HH-Global integration- Global integration HH measures the degree to which each line in the map is present on the simplest routes to and from all others lines. This measure has radius n (infinity).

Integration R3-Local integration- Local integration, termed integration radius 3, restrict the measurement of routes from any line to only those lines that are up to three lines away from it. This measure provides the localised importance of a space from access within a particular part of the building.

Justified graph- presents access relations between spaces and provides means of examining the distribution of depth from a root point that was selected.

Movement Traces-A space syntax observational method that is used in conjunction with the snapshot method, record the precise route taken by people moving through a space. Instead, the number of moving people through gates are counted after the event, where lines are drawn at the key locations.

Questionnaires- This type of study is appropriate to office organisations and workplaces where groups are relatively stable, activities relatively predictable and work tasks tend to unite some people regularly but divide them from others. This observation method involves using a precise and exhaustive questionnaire distributed to every member of the organisation incorporating citation and reverse citation about the frequency, duration and usefulness of contacts.

Segmental movements- Are the movements that pass through semi-regular grids. Segmental movements map the psychological benefits of moving in a theoretical straight line, cutting across the original grid.

Spatial diagrams -embodied diagrams –Embodied diagrams are multi-layered diagrams that are not merely representations of real-world space, but contain manifold implicit meanings pertaining to the experience of being situated in the equivalent real-world space.

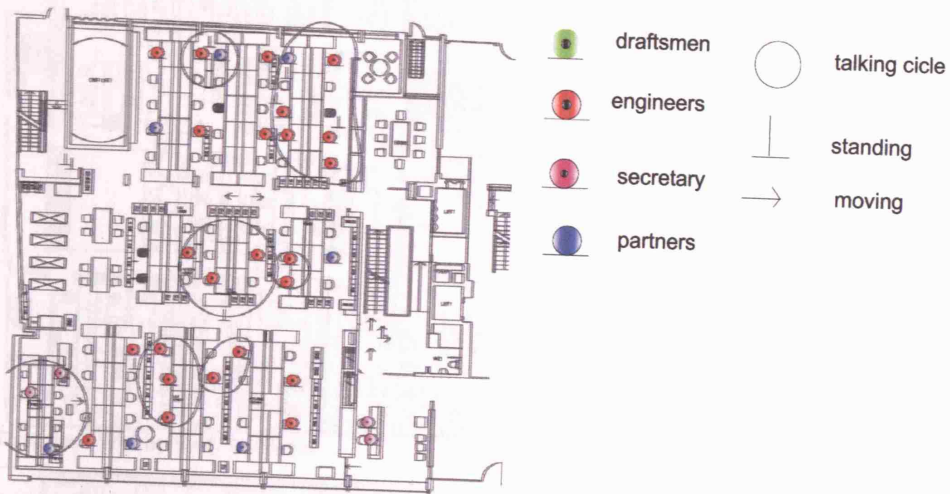
Static snapshots- A space syntax observational method that is used for recording both stationary and moving activities.

Synergy- Is the statistical relationship between local and global integration.

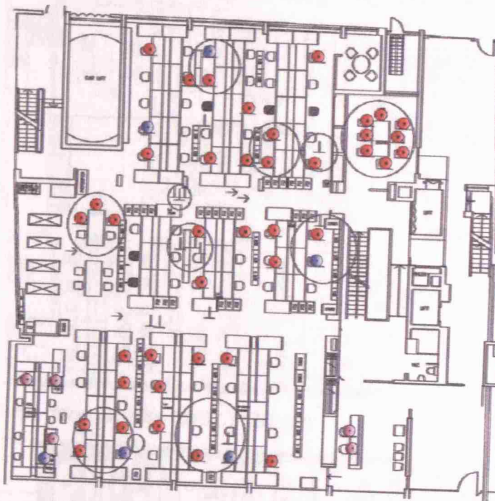
96

Visibility graph analysis- Provides a means of examining how integration is distributed within a system according to how visible spaces are from different points in the configuration.

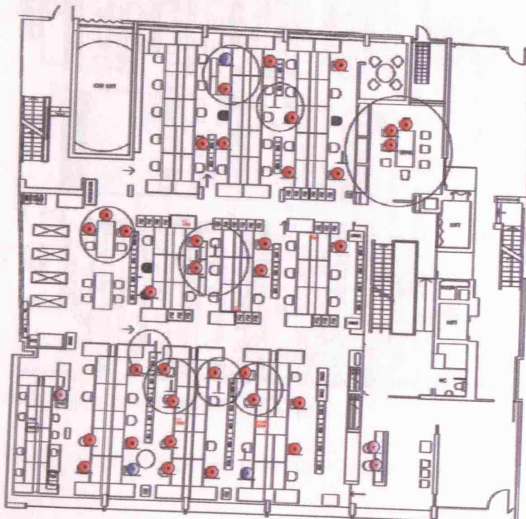
Appendix



Ground floor Whitby Bird, 9:30 am

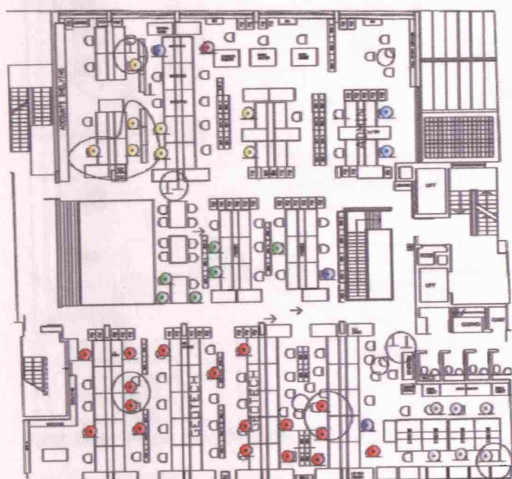


Ground floor Whitby Bird, 1:00 pm

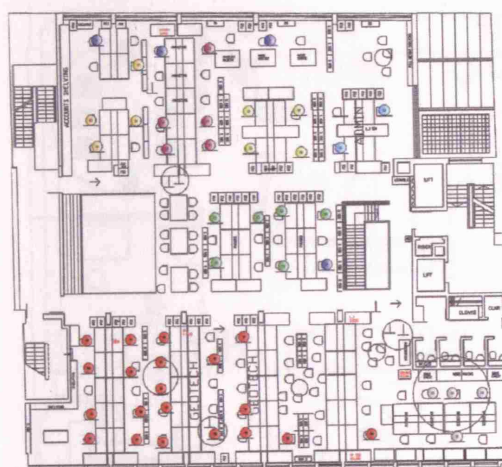


Ground floor Whitby Bird, 4:20 pm

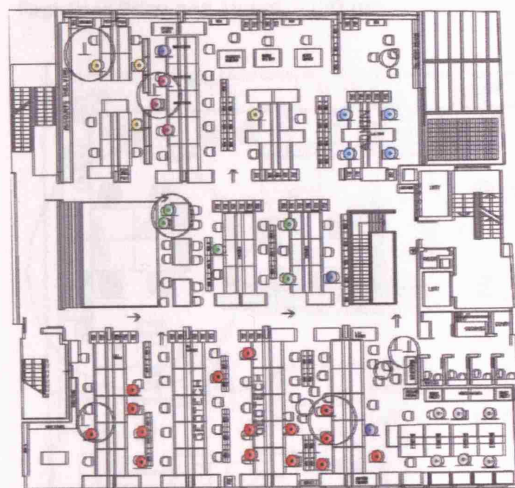
Figure A.1 Whitby Bird ground floor static snapshots three 3 daily periods



First floor Whitby Bird, 9:40 am



First floor Whitby Bird, 1:20 pm



First floor Whitby Bird, 4:30 pm

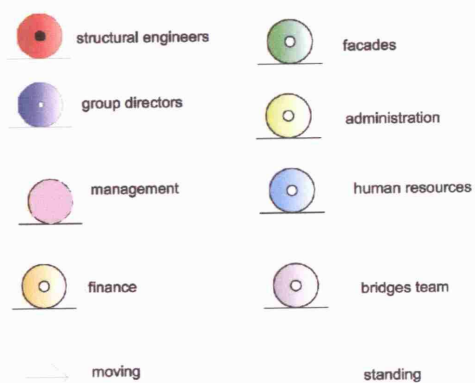
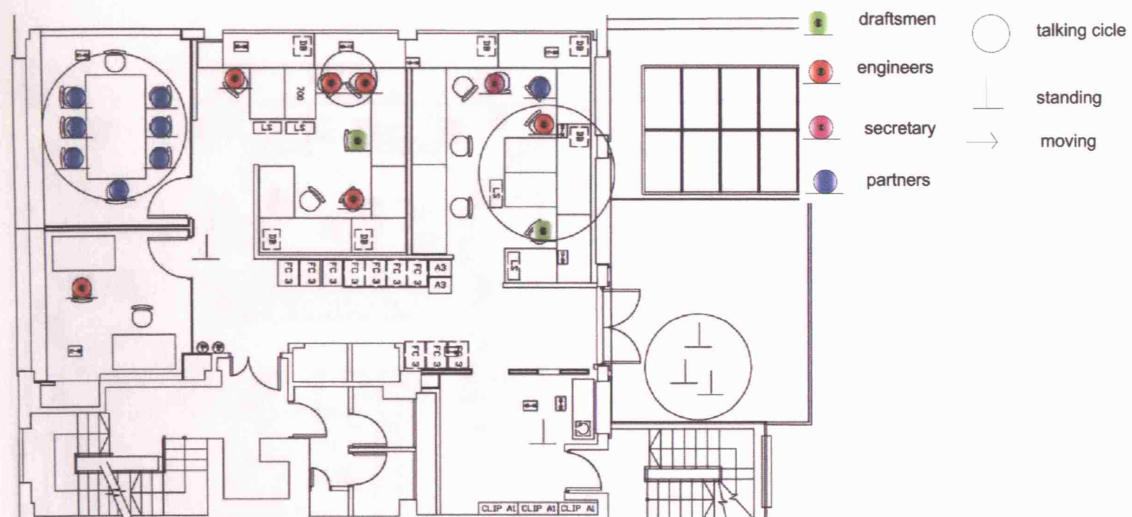
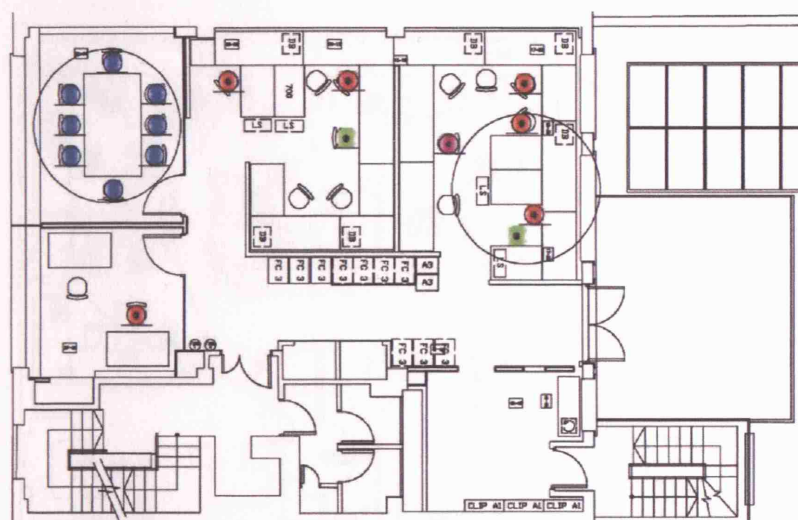


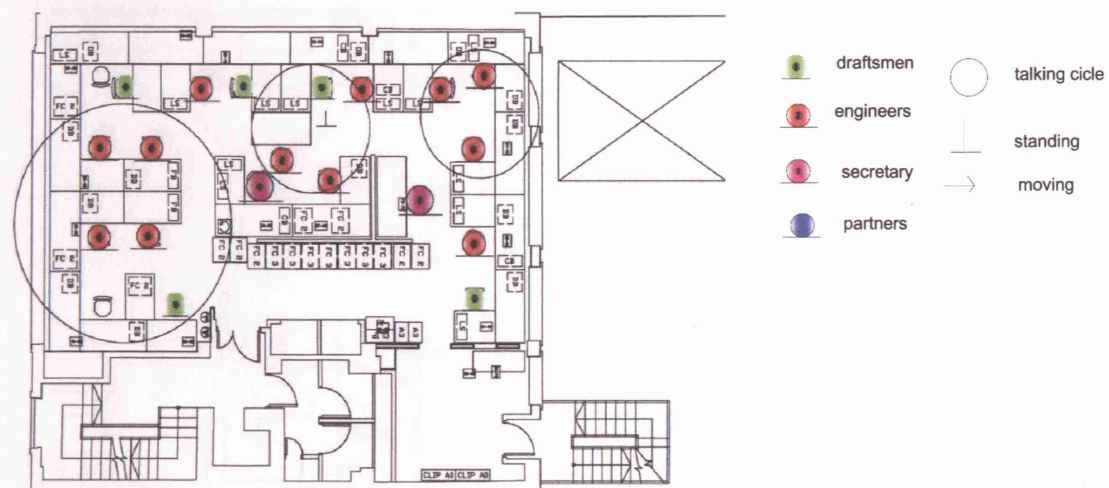
Figure A.2 Whitby Bird first floor static snapshots three 3 daily periods



First floor Price and Myers, 9:20 am

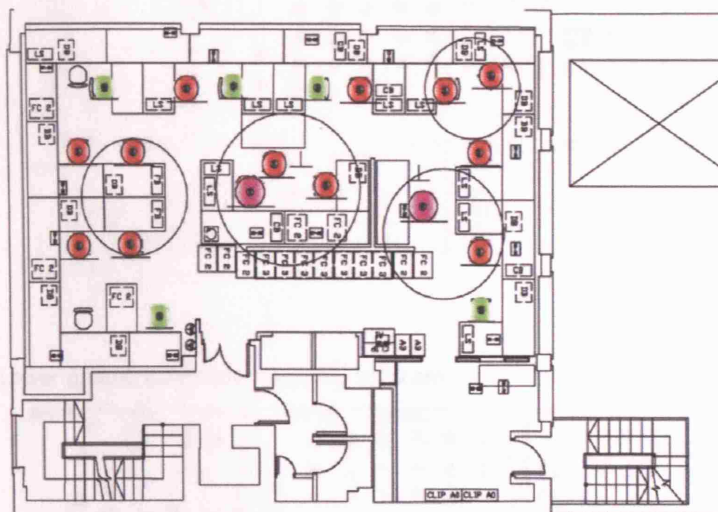


First floor Price and Myers, 1:30 pm

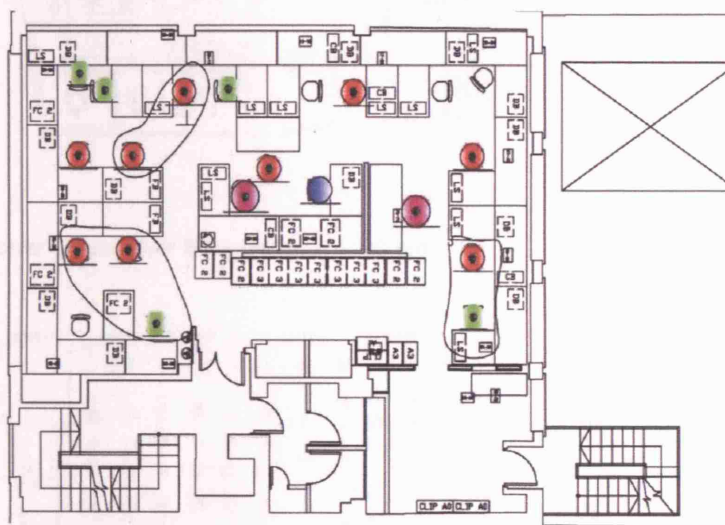


First floor Price and Myers, 4:30 pm

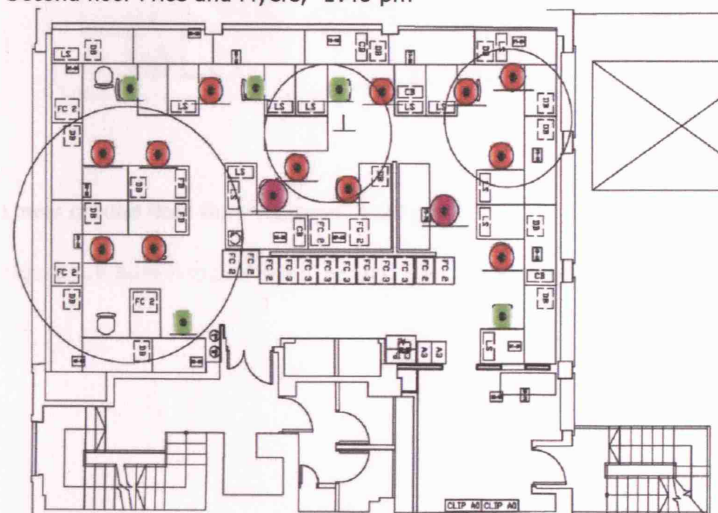
Figure A.3 Price and Myers first floor static snapshots three 3 daily periods



Second floor Price and Myers, 9:30 am



Second floor Price and Myers, 1:40 pm



Second floor Price and Myers, 4:40 pm

Figure A.4 Price and Myers second floor static snapshots three 3 daily periods



Lower ground floor Buro Happold, 9:20 am

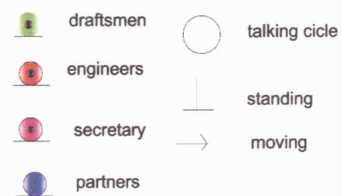


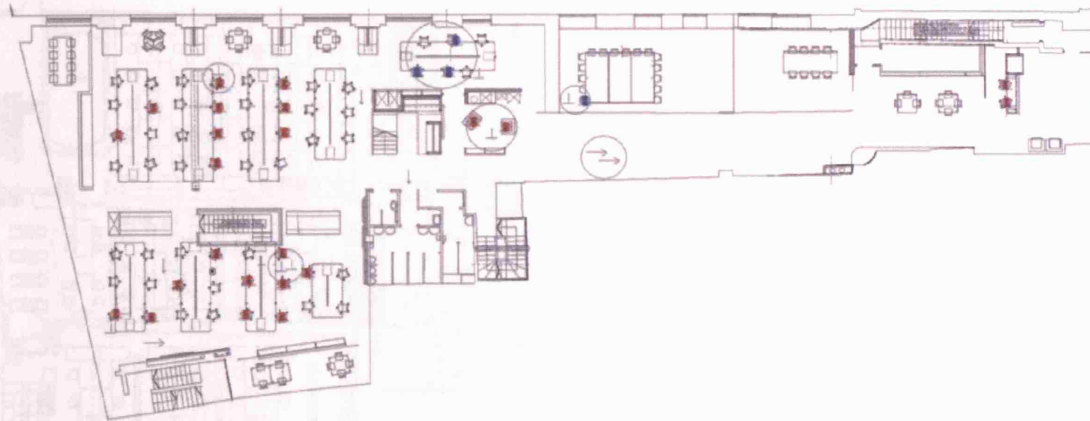
Lower ground floor Buro Happold, 1:20 pm



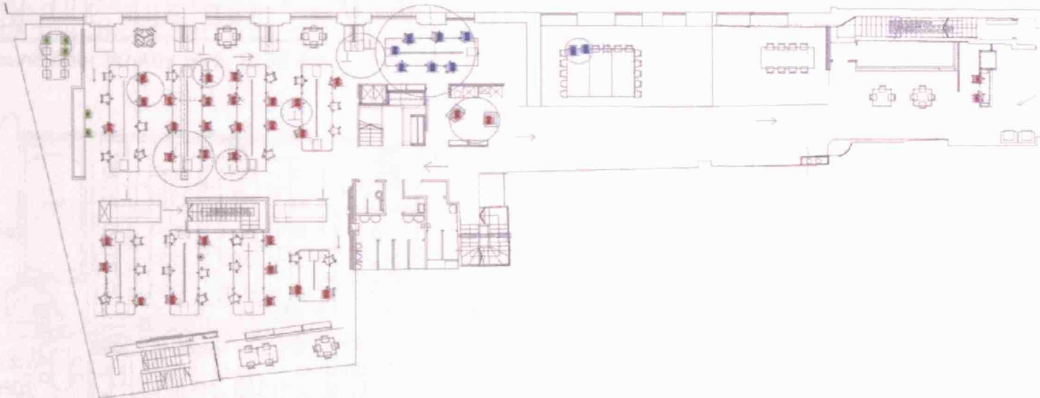
Lower ground floor Buro Happold, 4:20 pm

Figure A.5 Buro Happold lower ground floor static snapshots three 3 daily periods

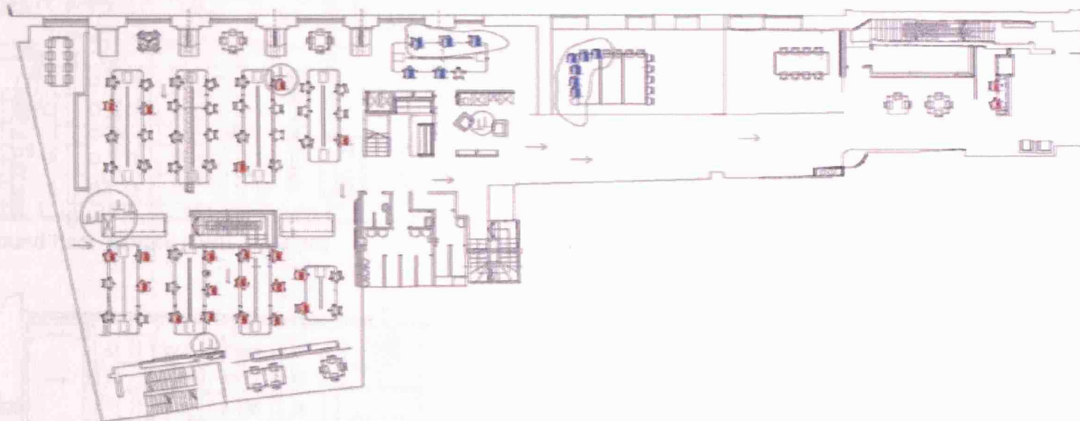




Ground floor Buro Happold, 9:30 am

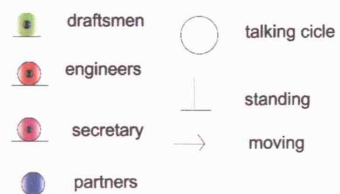


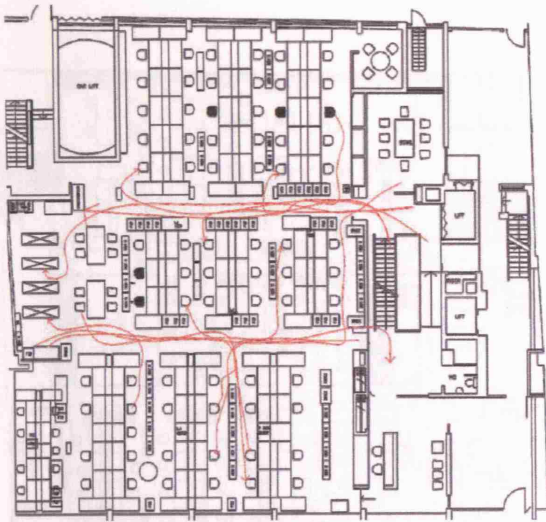
Ground floor Buro Happold, 1:30 pm



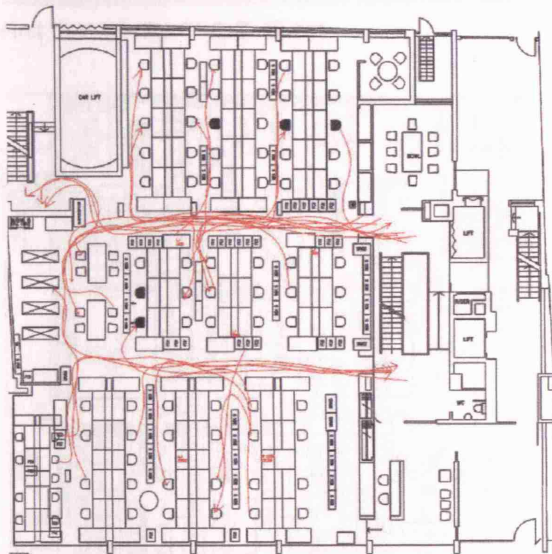
Ground floor Buro Happold, 4:30 pm

Figure A.6 Buro Happold ground floor static snapshots three 3 daily periods

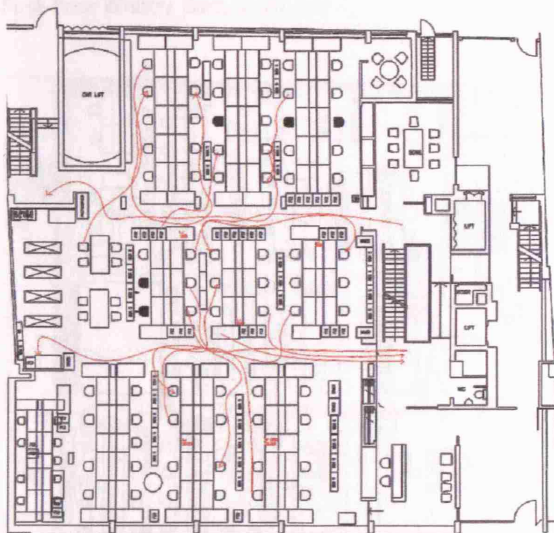




Ground floor Whitby Bird, 9:30 am

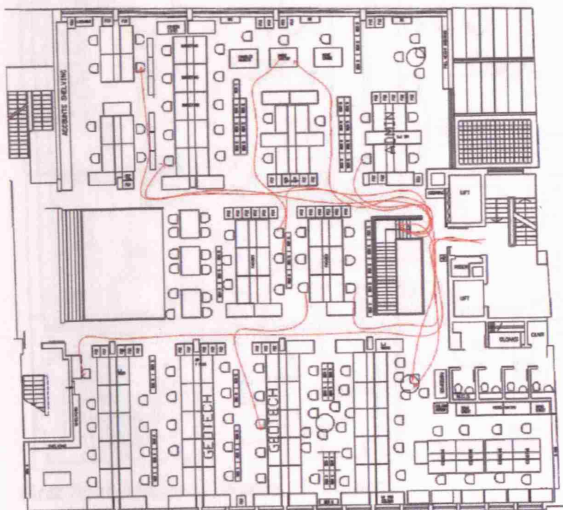


Ground floor Whitby Bird, 1:10 pm

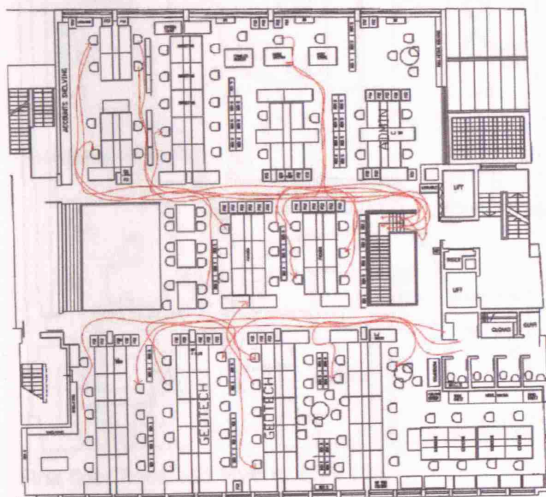


Ground floor Whitby Bird, 4:20 pm

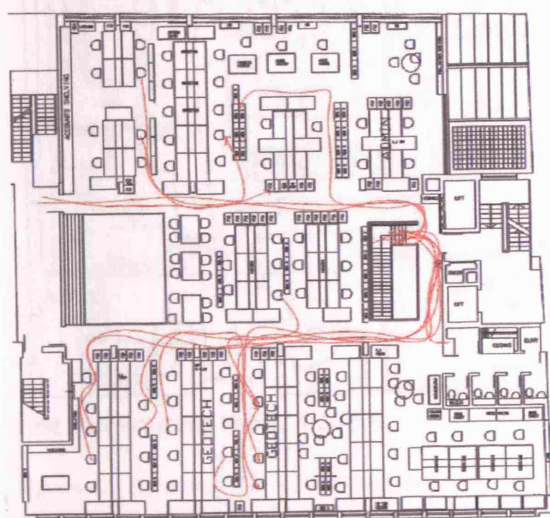
Figure A.7 Whitby Bird ground floor movement traces three 3 daily periods



First floor Whitby Bird, 9:40 am

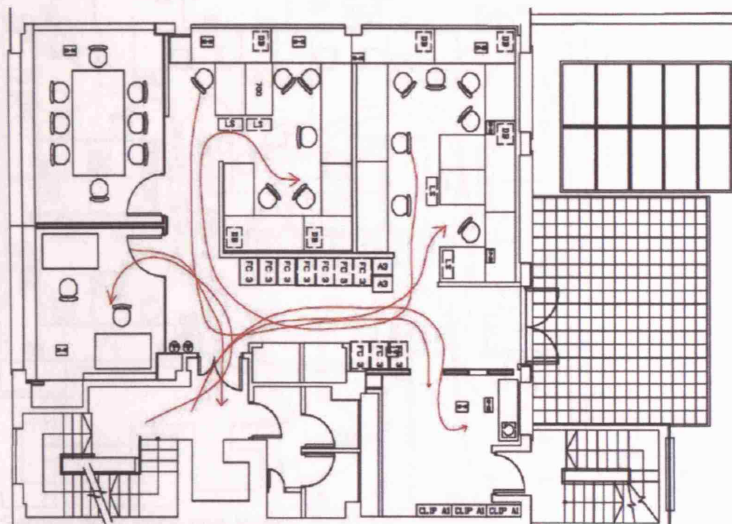


First floor Whitby Bird, 1:20 pm

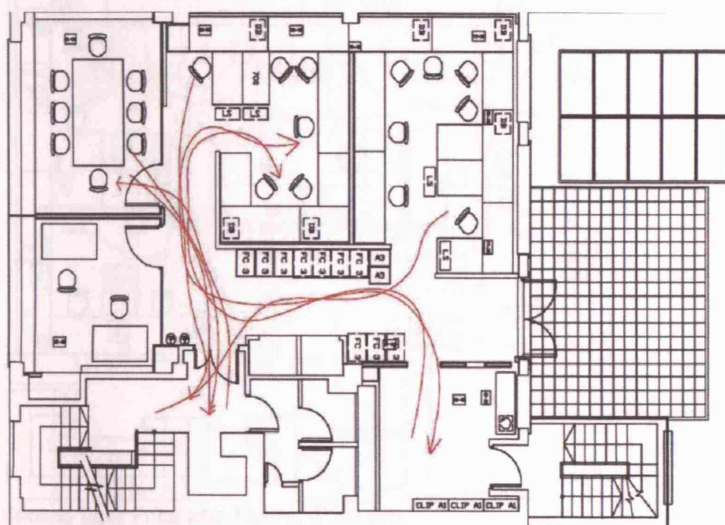


First floor Whitby Bird, 4:30 pm

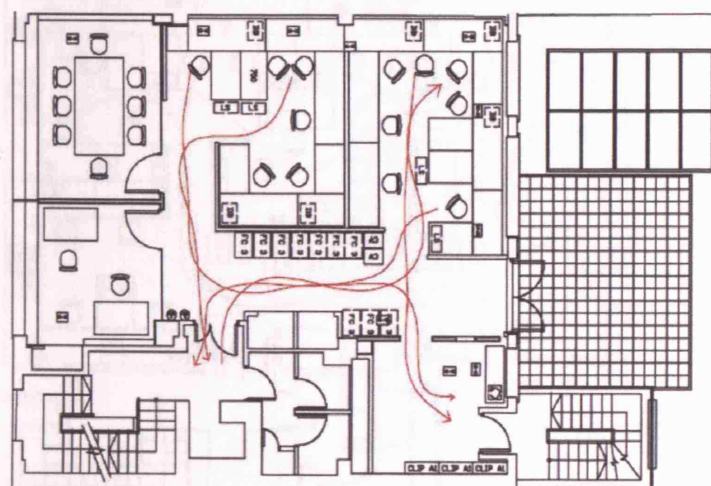
Figure A.8 Whitby Bird first floor movement traces three 3 daily periods



First floor Price and Myers, 9:20 am

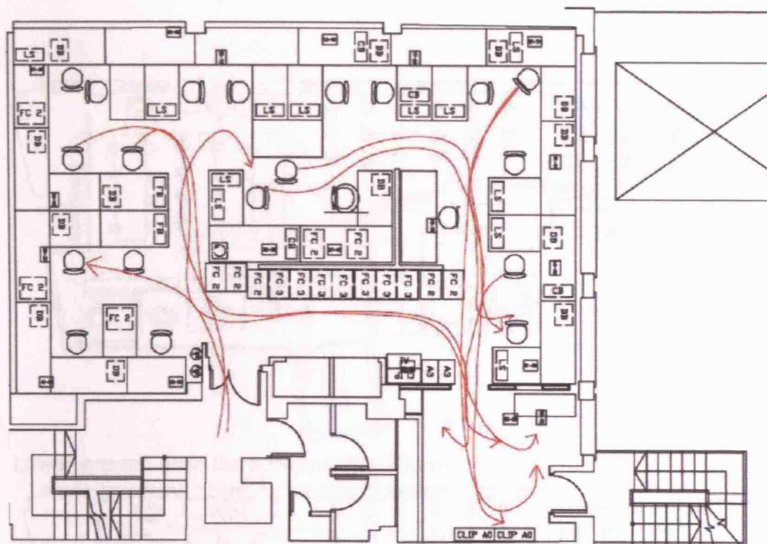


First floor Price and Myers, 1:30 pm

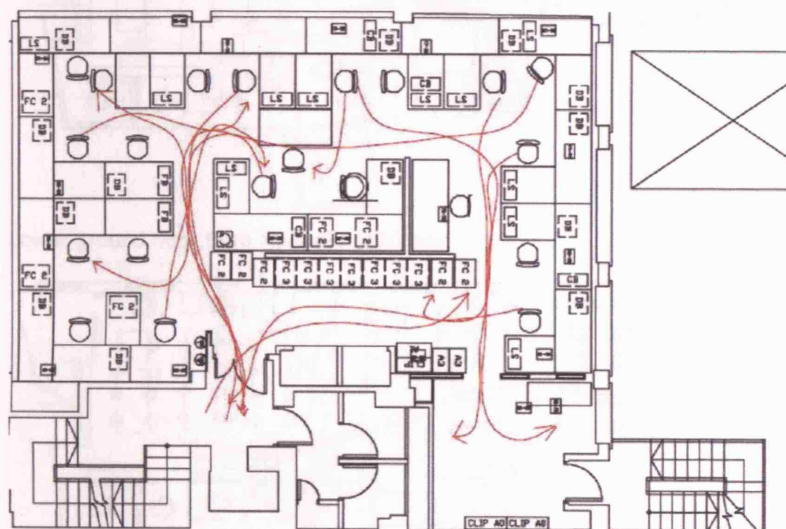


First floor Price and Myers, 4:30 pm

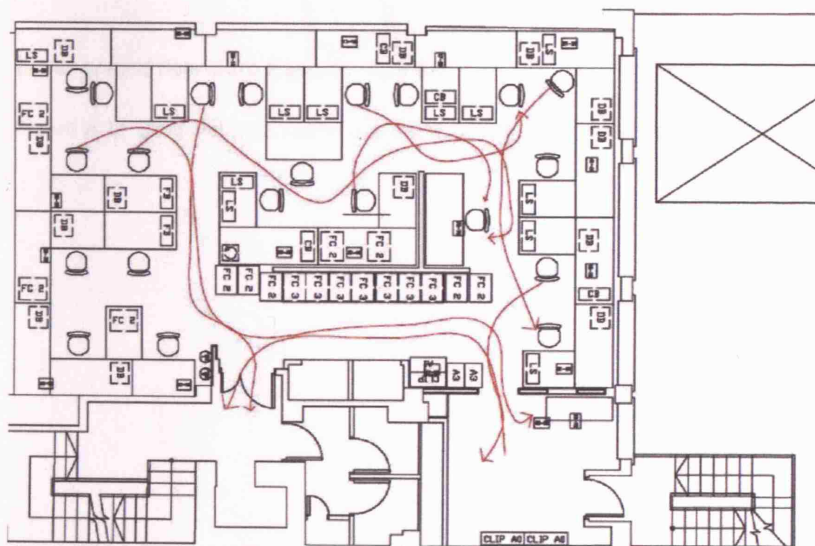
Figure A.9 Price and Myers first floor movement traces three 3 daily periods



Second floor Price and Myers, 9:30 am

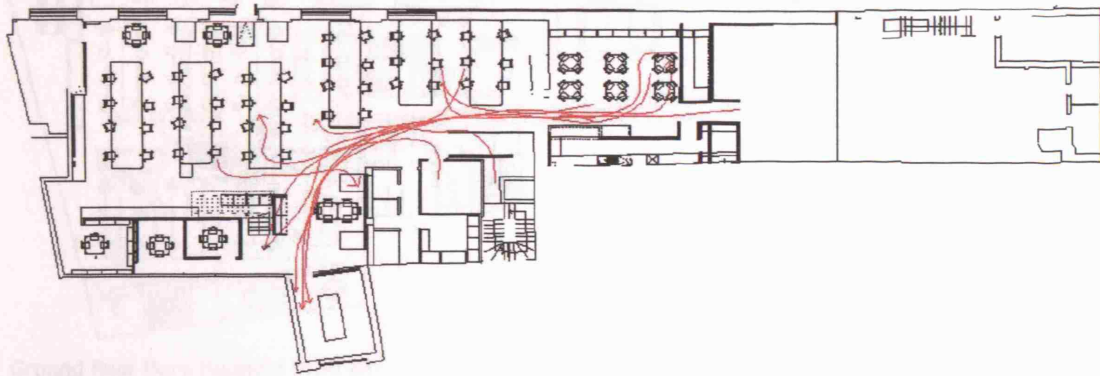


Second floor Price and Myers, 1:40 pm

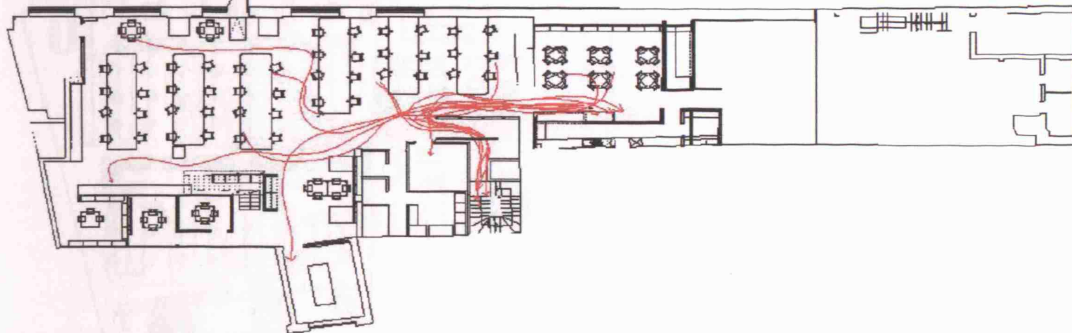


Second floor Price and Myers, 4:40 pm

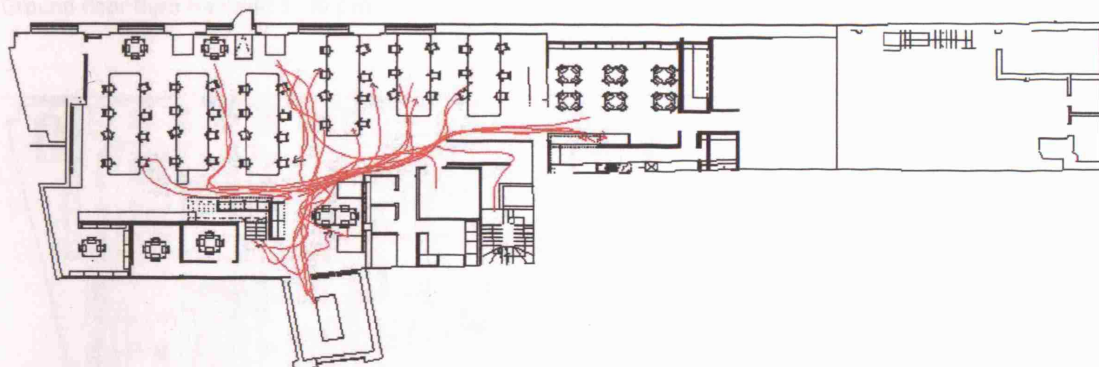
Figure A.10 Price and Myers second floor movement traces three 3 daily periods



Lower ground floor Buro Happold 9:20 am

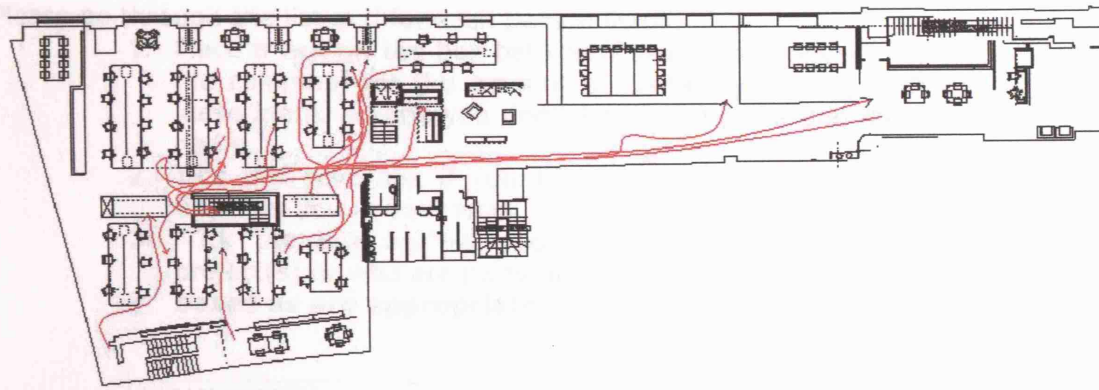


Lower ground floor Buro Happold 1:20 pm

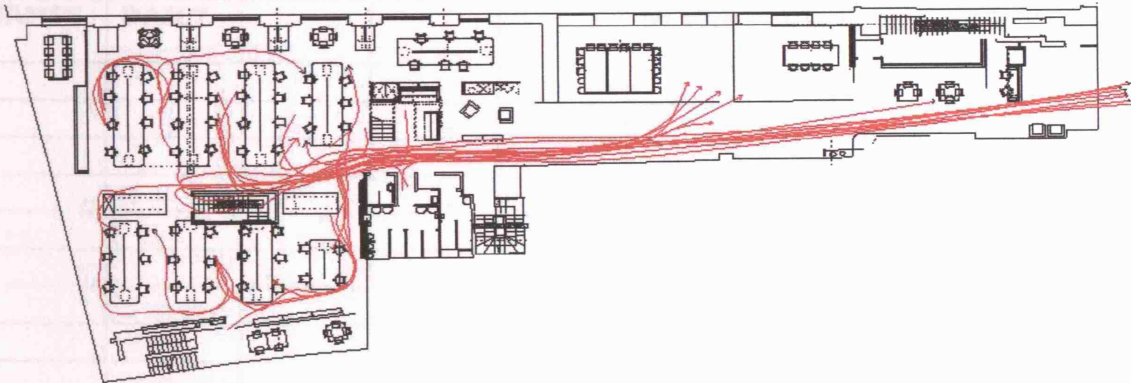


Lower ground floor Buro Happold 4:20 pm

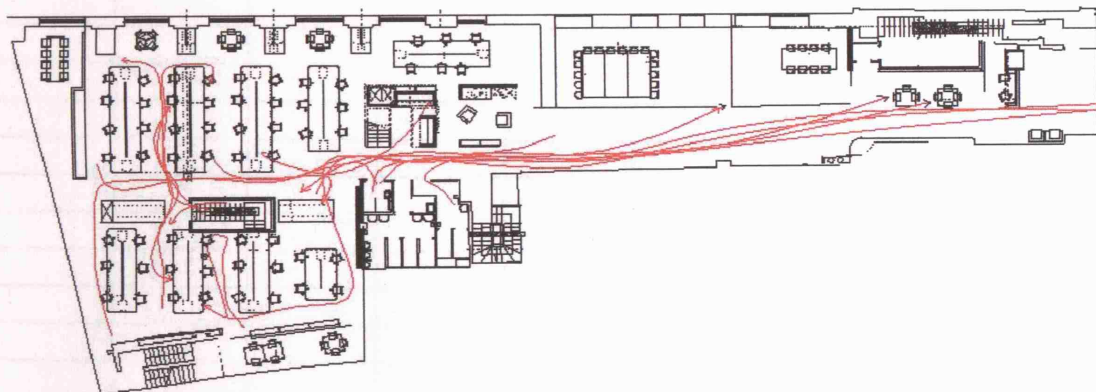
Figure A.11 Buro Happold lower ground floor movement traces three 3 daily



Ground floor Buro Happold 9:30 am



Ground floor Buro Happold 1:30 pm



Ground floor Buro Happold 4:30 pm

Figure A.12 Buro Happold ground floor movement traces three 3 daily

Please go through the list and for each person listed:

1. Place a tick on the box between "daily" and "never" (i.e., one of the five columns) for the amount of contact you have with the person; leave blank anyone you don't know and put a line through your own name.
2. Tick the next box if you find contact with the person particularly useful to you in your work.
3. Tick the box against people with whom you are involved in a project(s) or who are parts of your regular work team. **Tick as many boxes as are appropriate**

[illegible]

Figure A.13 questionnaire form